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The Gas Machinery Company

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Fish Cannery Calls Upon Gas for Assistance in Lowering Costs

Equipment Devised by San Diego Company's Industrial Department Merges Into One, Two Conflicting Operations—Cannery Operator Well Pleased With Increased Efficiency Obtained

By F. H. MUGG

Industrial Gas Engineer, San Diego Consolidated Gas & Electric Company, San Diego, Cal.

Not many years ago it was a hard matter to get people to eat canned fish, but through the tireless efforts of the United States Bureau of Fisheries and the few fish canneries that were in operation, the public has been taught that there are many varieties of fish that are excellent food and pleasing to the taste, and the result has been an amazing increase in the number of canneries in the United States. To-day this business is one of the leading industries on the Pacific Coast.

Owing to the great growth of this business, it is only natural that many improvements in machinery and other labor-saving devices should be made.

Lowering the Cost of Operations

Let us go back to the beginning of sardine packing and see what has been done to cut down labor, increase the pack and reduce the cost of this popular fish. After the fishermen had caught these fish, they cleaned them, spread them on racks and set them in the back yard to sun dry. When dry, they were taken to the cannery and packed. At that time the cans were made by hand, and after being packed the lids were soldered on by hand. Then came the machine-made can, but it was still necessary to solder the lids on by hand. Soon after this came the foot machine that rolled the top onto the can, but as this was operated by hand the average number of cans turned out per minute was about fifteen. At the present day we have the automatic machine that places the top and rolls it on at the rate of forty per minute.

The sealing of these cans is but one of the many operations necessary in this industry before the fish are ready for the market. The order of these operations is as follows: First they are cleaned, then washed, salted, washed again, dried, fried in oil, then allowed to cool so that they can be handled for packing. Then each fish is hand-packed when the necessary amount of olive oil or other ingredients are added. Then these cans are exhausted or preheated while on their way to the machine that rolls the top on. After going through all these operations the cans are now ready for retorting.

DRYING DONE BY BATTERY OF GAS OVENS AND LARGE MULTIBLADE FAN

They are then placed in large racks and run into the retort, where they are cooked for a given length of time under steam pressure.

Major Part of Work Done by Hand

As most of this work is done by hand, we can readily see that each cannery is looking for some way in which to increase its output and decrease the cost per case, and at the same time better the quality of the product.

Take, for instance, drying and exhausting.

The reason for drying the sardines is that when the can is opened no water will be found in the can, as this spoils the quality of the pack. Drying is one of the most costly operations through which the fish must go.

Exhausting or preheating before sealing the can is necessary so as to create a vacuum which draws in the heads of the cans and holds the fish firm, but the main reason for exhausting is that the cans may not bulge during hot weather or when put in the display window. All fruits, fish, etc., packed in tin cans go through this operation. The old way of preheating was to run these cans through a long box filled with live steam, which naturally condenses and leaves a certain amount of moisture in the can.

Calling in Gas to Simplify Process

Now you can see how these two operations of drying and exhausting conflict. First the fish are dried so as not to leave water in the can, then the open cans are run through live steam, which leaves a certain amount of moisture from condensation.

Gas Equipment

H. F. Wheeler, of the Wheeler-Chase Fisheries, saw the inconsistency of these two operations, so-called, on the industrial department of the San Diego Consolidated Gas & Electric Company, and wanted to know why gas could not be used for exhausting. We immediately got on the job and designed the necessary equipment for this operation, and the result was so pleasing and satisfactory that they are now using gas for exhausting and also drying.

EACH EXHAUSTING MACHINE EQUIPPED WITH EXHAUST BOX 20 FT. LONG, IN WHICH FOUR DRILLED BURNERS SUPPLY HEAT

Each machine is equipped with an exhaust box 20 ft. long, which is made of sheet metal. Four drilled burners are used. Each burner is 5 ft. long and controlled with a separate valve, or all can be controlled with one valve; also each burner is equipped with a gas range top lighter, so that no matches are necessary. The accompanying photograph shows one of the boxes set up and ready for use. Another photograph shows three machines, each one equipped with a separate exhaust box.

The cost of operation is very light, but owing to the different size cans and the irregularity with which

they pass through the exhaust box we have never been able to get the cost per can or per case, but we can say that Mr. Wheeler is more than pleased with the installation.

The drying is done with a battery of gas furnaces and a large multiblade fan. This outfit will deliver 450,000 cu. ft. of air per hour at a temperature of 125 deg. Between the washer and the cannery is a space of 300 ft., and the fish are spread on trays and carried this distance on cables which move at the rate of 12 ft. per minute. These cables were encased, making a tunnel through which warm air could be blown, and on one end of this tunnel the gas furnaces and blower were installed. Owing to the location of these furnaces, we were unable to get a photograph of them after they were installed, but the accompanying photograph shows the type of equipment used.

THREE GAS-FIRED MACHINES EACH EQUIPPED WITH A SEPARATE EXHAUST BOX

Plan to Operate All Industries at Full Capacity, but Make Each Pound of Fuel Perform Its Maximum Service in Power, Light and Heat

Estimated That 10 to 20 Per Cent of Fuel Now Used in Power Plants Can be Saved by Improvements in Operation Alone

The United States Fuel Administration announced May 8 the appointment of Thomas R. Brown, of Pittsburgh, Pa., as administrative engineer for the Pittsburgh district, and C. P. Billings as special staff assistant. These appointments were made as a preliminary step toward putting into operation a general plan for fuel conservation in power plants.

This plan is the result of conferences with the Federal Fuel Administrators and their committees for the group of States which together consume about 70 per cent of all the coal used in the United States, exclusive of railroads. The plan has received the indorsement of the Fuel Administrators of all these States, as well as approval of the United States Bureau of Mines and a committee representing the Engineering Council of the four national engineering societies.

The slogan of the campaign is "Maximum production with minimum waste." In other words, the object is to operate all industries at full capacity, but at the same time to make a pound of fuel perform its maximum service in power, light and heat.

In laying the foundations for the organization it has been anticipated that this work should become a permanent service of the Government.

Ten to 20 per cent—that is, from twenty-five to fifty million tons of coal per year—can be saved by the correct operation of steam power plants, using their present equipment, in the industries, in office buildings, hotels, apartment houses, etc.

Vast Saving of Coal Can Be Accomplished

It is considered most important that all existing fuel-conservation committees, committees of chambers of commerce and national defense, manufacturers' associations and other bodies be continued in full force, and that the work of such organizations be consolidated with the national program, which comprises certain fundamentals, as follows:

1. Personal inspection of every power plant in the country.

2. Classification and rating of every power plant, based upon the thoroughness with which owner of said plant conforms to recommendations.

3. Responsibility of rating the plants will fall upon an engineer in each district, the rating to be based upon reports of inspectors, who will not express opinions, but will collect definite information. The State Fuel Administrator, in his judgment, may entirely or partially shut off the consumption of coal to any needlessly wasteful plant in his territory.

4. Inspectors are to be furnished from one or more of the following sources: (a) Inspectors of the steam-boiler insurance companies; (b) State factory inspectors; (c) engineering students from technical colleges; (d) volunteers.

The ratings will be based upon recorded answers to questions, each of which will be given a value depending upon its relative importance to the other questions. Depending upon the efficiency of methods in use in any plant, it may be rated in class 1, 2, 3 or 4.

Savings Figured on Present Equipment

The ratings will be based upon existing equipment. The difficulty, delay and expense involved in the installation at this time of improved power equipment is fully recognized, but experience has proved that 10 to 20 per

cent of fuel now used in power plants can be saved by improvements in operation alone.

In advance of the first inspection a questionnaire will be sent to every power plant in each district, with notice to the owner that within sixty or ninety days his plant will be inspected personally and the questionnaire will be checked up by the inspector upon his visit. This action will tend to prepare the minds of plant owners for what will follow. It will operate to induce proper care in furnishing information and will also tend to produce a desire to improve their plants, if necessary, so that they may be rated in a high class by the time the inspector calls.

It is recommended that a board of competent engineers be attached to the conservation committee in each State; also a corps of lecturers to arouse public interest and disseminate engineering information.

The Fuel Administration has prepared a fifty-minute film of moving pictures showing good and bad operation in the steam-boiler plant, methods of testing boilers, fuels, etc. These pictures will be available for each State in connection with its educational propaganda.

The administration is also preparing a series of official bulletins on engineering phases of steam and fuel economics. Some of these are now ready for printing. They will include:

1. Boiler and furnace testing.
2. Flue gas analysis.
3. Saving steam in heating systems.
4. Boiler-room accounting systems.
5. Saving steam and fuel in industrial plants.
6. Burning fine sizes of anthracite.
7. Boiler water treatment.
8. Oil burning.
9. Stoker operation.

In addition to this service, a list of competent engineers has been prepared in Washington for each State and is available for use of each local administration. As the work develops, still further constructive assistance is contemplated for helping owners to bring their plants up to a high plane of economic operation.

When Public Ownership Becomes Practical

I do not believe in the theory that all enterprise can be carried on by the Government wisely and well, because those of you who have had administrative experience know that managerial ability is rare; that governmental methods are wasteful; that there are things which have been standardized which can safely be left to the hands of Government, but that, above all, we must save personal initiative, the inventive power of the human mind. God has given to us something called a mind, which has a radioactive power, from which comes light and heat. Put the compressing hand of Government upon that mind, and it atrophies, it deadens, it dies. The purpose of liberty, the purpose of democracy, is to keep that mind lively and vital every moment, so that whatever is in it, no matter where it comes from, may be given off for the benefit of men. It is only from a free people, with free minds, that the world gains, and so Government itself must not compress the human mind, from which all things come. But where a point of standardization has been reached in an industry, why should not Government take that industry into its own hand and carry it on? It is only a question of governmental efficiency.

I ask you this question: Even with governmental inefficiency, are we not going to take things into our own hands unless business, large business and small business, gains a real social sense? And what is a social sense? It is the relation between your dollar and my need; between your power and my heart. We cannot have a republic that will be lasting unless those who control industry feel for me and with me; unless they regard me as entitled to a portion of what they undertake to make with their money—a partner with them. Surely it is not so, that there cannot be invented in this world some new kind of co-operation, in which the worker himself can have a part.

There are great ramifications to this thought, and it is necessary that common sense should be exercised in curbing the power, because when a people collectively get a lust for doing things they may go to dangerous lengths. But work is to make us, as work has made us, and the man who works is the man who is to be master. —*Secretary of the Interior Franklin K. Lane.*

Our Real Knowledge of Coal Very Limited

When they came to think about it, the scientific knowledge we have about coal and coke is extraordinarily little, asserted Dr. J. T. Dunn, in an address before the Coke Oven Managers' Association at Newcastle-on-Tyne. We know there are great differences and varieties of coal, particularly in regard to coking. Some coals yield a very good coke, others no coke at all, but simply an incoherent powder, and between these two limits there are all sorts of varieties and differences. Until a few years ago nothing was known as to the real nature of coal, and although a great deal of work has been done on coal within the last twenty years, the definite results are really very meager. Dr. Bedson started the work on the action of solvents, and of pyridine in particular, while others have worked by means of phenol or benzene. The object of this work was to find out by extraction what the coal contains. Yet the extent of our knowledge in this respect is capable of being very briefly summed up. There are two constituents in most coals—one soluble in pyridine and the other not. The first is more or less of a resinous character, corresponding to the resinous constituents of the original vegetable substance, while the other, insoluble in pyridine, is humus-like—a sort of degraded product of cellulose—and appears to be derived from the woody tissue of the original vegetation. It has been found that the resinous constituents have to do with the coking quality in coal, and, in fact, it swells and intumesces very strongly, whereas the other constituent does not. That is about the extent of our knowledge in that direction. In an empirical sort of way we know that these coals which contain plenty of hydrogen and very little oxygen do not coke; also that those which contain a lot of oxygen and very often a good deal of hydrogen do not coke; while the coking coals contain intermediate quantities of hydrogen and oxygen. Further, we know that if a coking coal is exposed to the weather it tends to lose its coking property. But here, again, we soon reach the end of our knowledge, for experiments in these directions have been done by a very small number of investigators, and on a very small number of different coals.

Whole Natural Gas Industry Today Responsive to Problem of Chemical Possibilities of Natural Gas

Foodstuffs From Gasoline—Dr. J. B. Garner Declares Natural Gas Forms the Hydrocarbon Basis Upon Which an Artificial Rubber Industry Can Be Built—Subsidized Chemical and Engineering Research the Keynote to Commercial Realization of Possibilities of This Age

In the early development of the natural gas industry little thought was given to faulty valves, gates, couplings, regulators and other appliances connected with the drilling, production, transmission and distribution of natural gas. A goodly proportion of the gas that was produced was lost for the reasons that the appliances used were faulty, declared Dr. J. B. Garner, in a paper presented at the annual meeting of the National Gas Association of America, held this week at Pittsburgh. These were at once obvious and apparent. The producer could easily see his potential profits dissipated into the air, and as the result of the situation, he was forced to go to the engineer to devise for him new and less wasteful methods of handling his gas. The value of the results of the work of the engineer along these lines was at once recognized because of the increased balance on the right side of the ledger. The producer was convinced that the engineer was a necessary adjunct to his business. Later on, when well pressures declined and it became necessary to install large compressing stations, gas cooling coils, etc., the need of the engineer became more and more apparent, because of the numerous mechanical and electrical problems which arose from the successful operation and maintenance of gas compressing stations. The most enterprising of these companies secured the services of highly trained as well as intensely practical scientific and technical men. There is no country on the face of the earth which is so highly specialized in the compression and transmission of high pressure gas.

A Valuable By-product First Regarded as a Nuisance

Simultaneously with the installation of machinery for the artificial compression of natural gas in order that it might be economically transported to market, there was a decided lowering of the pressure on the well. Perhaps as a consequence of the lowering of the well pressure it has since been discovered that some less volatile gas was obtained, and by the process of compression and the consequent cooling of the gas minor quantities of these less volatile hydrocarbons were sometimes deposited as liquid in the transportation lines. This usually took place in cold weather, and occasionally this liquid would collect at a low point in the line in association with quantities of water and would interfere with the transportation of the gas. At low temperatures the water would freeze and the result would be the bursting of the pipe line. Not only were large quantities of gas lost when this happened, but the service to the customers who needed the gas was interfered with at a particularly inopportune time. The deposit of these liquid hydrocarbons also sometimes injured the rubbers of the couplings to such an extent as to render it a nuisance to the producer. The producer therefore again consulted the engineer, and drips were devised in which the liquid deposited in the pipe line could be periodically removed without interfering with the transmission of the gas. The liquid hydrocarbons thus collected, when separated from the water, came to be known as drip gasoline. It was not obtained in quantities sufficient to render it an article of commerce, though quantities of it were sometimes sold to refineries.

The Work of Saybolt

At about this time an enterprising and far-seeing chemical engineer, George M. Saybolt, conceived the idea, contrary to the general notion, that there might be enough of the heavier hydrocarbons existing in the form of vapor in natural gas to justify an effort for their commercial extraction in liquid form. Starting with this idea, Mr. Saybolt invented a method of extracting these vapors and engaged in a series of experiments under the auspices of a large natural gas producing company which interested itself in his work. The result of Mr. Saybolt's experiments was the conviction not only that gasoline could be extracted from natural gas, but that the process which he had invented was a highly successful one for that purpose. The first plant for obtaining gasoline by his method was installed and placed in operation in August, 1913, and soon another surprising fact was learned, namely, that the gasoline so obtained was one of a particularly high quality and different from any other then on the market.

You are all conversant with the growth and development of this remarkable natural gas gasoline industry. It is now perfectly apparent to any one connected with the natural gas industry that gasoline can be extracted in commercial quantities from natural gas and that adequate returns are to be had from the investment required. Ten years ago, however, the story was different. All of this progress, development and growth in this industry we owe to the pioneer efforts of the chemical engineer—George M. Saybolt.

Composition of Natural Gas

Natural gas is composed almost entirely of paraffin hydrocarbons in varying proportions—methane, ethane, propane, butane, pentane, hexane, reptane and octane. Nitrogen, carbon dioxide and helium may exist in small quantities. The first two of the hydrocarbons are fixed gases; that is, gases which liquefy only at very low tem-

peratures and high pressures. Propane and butane are normally regarded as gases, but are intermediate in their properties between a true gas on the one hand and a true liquid on the other hand. Pentane, hexane, heptane and octane are normally liquids at atmospheric temperature and pressure. Most commonly methane is the predominating constituent and octane is the hydrocarbon, which occurs to the least extent in natural gas.

These compounds are called "paraffin hydrocarbons," because they are thought to be compounds which show little or no chemical reactivity. This means, in other words, that they are substances which, when subjected to forces that bring about chemical change, undergo this change only with the greatest difficulty, or only when in contact with the most energetic chemical reagents.

Affecting Chemical Changes

Chemical change refers to any change in a substance which affects its composition, or, to put it in other words, when a substance undergoes chemical change the identity of the substance is lost. For example: when natural gas is burned in air, both the air and the natural gas undergo chemical change, since the product resulting from the burning of the natural gas in the air is entirely different from either natural gas or air. The products of this chemical change are carbon dioxide, water and nitrogen. The product is no longer valuable as fuel or illuminant, or capable of sustaining animal life. A definite and fixed quantity by weight of both natural gas and air have been required to bring about, under a certain set of conditions of temperature and pressure, this chemical change. This explanation is offered so that a clear understanding may be had of that which constitutes chemical change.

Chemical changes in general are effected in two ways:

1. The substance which is to be studied chemically is subjected, in the absence of all other substances, to some form of energy, as light, heat or electricity.

2. The substance which is to be subjected to chemical change is placed in contact with a definite weight ot another substance, and the mixture subjected to some form of energy in the presence or absence of small quantities of a foreign material known as a catalyst. Catalysts have for their purpose the hastening or retarding of the final state of the change.

The first of these methods of effecting chemical change is illustrated by the following two well-known reactions:

1. When ordinary sugar is heated, the final results of the heating are carbon and water.

2. When high boiling petroleum distillates are heated under pressure at temperatures from 500 to 550 deg. C. "cracked" gasoline is produced, while if the temperature is from 650 to 750 deg. C. aromatic hydrocarbons, such as benzol and toluol, are produced. In order to understand the chemical changes which have occurred by the simple heating of these substances, it may be well for us to visualize all substances as being of a grained structure, and that the grains composing the structure are held together by a pull force, i. e., a force which tends to keep the particles or grains together. The pull force which holds together the atoms of hydrogen and carbon making up the substances we know as methane, ethane, propane, etc., is called chemical force or chemical affinity. So long as this pull force is in excess of any external force tending to separate the atoms from one another, or push them apart or rearrange them, the substance does not undergo any chemical change, but when that situation is reached where the external energy is stronger or greater than the energy which holds the particles together, chemical change results. Thus, when a substance is heated, energy in the form of a separating force is being added to the substance. The addition of this energy to the substance intensifies the motion of the particles making up the substance, and thereby lessens the chemical affinity which holds them together. If the rapidity of motion of the atoms composing the substance becomes so great that the particles no longer can hang together due to the action of chemical affinity, a chemical change takes place; or, in other words, chemical affinity ceases to act when the atomic vibrations reach a certain limiting value.

The second of these methods of effecting chemical change is illustrated by the following series of experiments which will be performed here at the table. I have here what is known in chemical laboratories as a Kipp apparatus. This apparatus contains in the middle portion some ordinary granulated zinc. The upper and lower portions contain dilute sulphuric acid. When the zinc and sulphuric acid are brought into contact by manipulation of the stopcock from the middle portion, hydrogen is produced, and escapes through the opening in the stopcock. Attached to this stopcock is a piece of rubber hose, terminating in a small piece of glass tubing drawn to a capillary. You will observe that upon opening the stopcock, hydrogen gas escapes into the air, and that this escape occasions nothing more than the admixture of hydrogen with the air—a change similar to that which would occur when a valve on a gas line is opened. I have here a piece of iron wire which I will heat to several temperatures, so that I may expose the stream of hydrogen gas as it mixes with air to different degrees of heat, the purpose being to show that this mixture of hydrogen and air must be raised to a definite temperature before the hydrogen will burn and thus undergo a chemical change. You will observe that when the iron wire is heated to a slight extent the hydrogen does not burn, but when the wire is heated to redness, burning results. The exact temperature at which hydrogen in the presence of air begins to burn is 700 deg. C. By this experiment, I have shown that hydrogen, when mixed in air, requires the addition of a certain amount of energy to cause these two substances to undergo chemical change at a noticeable rate. Energy in the form of electricity might have been added here with similar results.

Chemical Characteristics of Natural Gas

In order that you may have some tangible and definite idea of what a catalyst is, I have prepared some platinum black, and have it here in this bottle. This platinum black has been prepared by taking some asbestos fiber, moistening it with a solution of platinum chloride, and then heating the mixture red hot. This sample of platinum black is nothing more or less than asbestos covered with finely divided metallic platinum. Platinum black is a catalyst widely used commercially. You will notice that this platinum black is cold. I will now introduce it into this stream of hydrogen, and you will observe the effect of this catalyst upon the mixture of hydrogen and air. The hydrogen bursts immediately

into flame, and the results are the same as when the hydrogen was heated to a definite temperature by means of the iron wire. I do not know why or how platinum black causes this chemical change to take place, but you know that it does take place very readily, and at much lower temperatures than we had.

So much then for the above general presentation of the chemical characteristics of the constituents of natural gas, what chemical change is, and how chemical changes may be induced or caused to take place. We are now in a position to begin our study of the chemical possibilities of natural gas.

First Plant for Recovery of Natural Gas-Gasoline by Absorption Method

In order that this subject may be simplified and at the same time made more intelligible, I desire to direct your attention, in the first place, to the processes which have for their purpose the separation of natural gas into its constituents; in the second place, to the chemical changes which natural gas as a mixture, or its constituents separately, will undergo when subjected to heat under varying conditions, and in the third place, to the change which the constituents of natural gas will undergo when subjected to chemical change in the presence of other substances with and without catalysts; and in the fourth place, to the valuable by-products which may be obtained by synthetic chemical reactions from the exhaust gas of gas engines.

Getting Amyl Acetate at Home

Since August, 1913, when the Hope Natural Gas Company installed the first absorption gasoline plant for the recovery of gasoline from natural gas, the natural gas-gasoline industry has experienced a rapid and remarkable growth. There are in existence at the present time more than 100 plants in the United States with a conservatively estimated production for the year in 1918 of more than 90,000,000 gal. The extraction of gasoline by this method has in no way affected the value of natural gas as a fuel. It has made the production of natural gas more profitable; it has made the service to consumers more efficient, less interrupted and more satisfactory. It has been one of the most important factors devised or invented having to do with the conservation of our natural gas resources. Probably no other factor has been so noteworthy in this direction. It has not only utilized and saved that which was formerly wasted, but it has enabled producers of motor fuel to meet the demands of the market for this material in a manner which would have been exceedingly difficult if at all possible in the present status of the oil industry. Petroleum distillates which of themselves are not utilizable as motor fuels are, when blended with natural gas-gasoline converted into satisfactory motor fuels. From the nature of the occurrence of gasoline as vapor in natural gas, one can readily understand why natural gas-gasoline contains relatively far more of the lower boiling hydrocarbons, pentane and hexane than is contained in refinery gasoline. It is the relatively large proportion of these two hydrocarbons that gives to natural gas-gasoline its greater value, and that has to the present time made it an article of great chemical importance.

At the outbreak of the present great world war, unusual chemical demands were made of American industry. One of the foremost of these demands was for explosives or munitions. A chemical compound known as amyl acetate is extensively used in the explosive industries. Prior to the war, Germany furnished practically all the world's supply of this material. All that was made in America was made from amyl alcohol and acetic acid. A review of the patent literature discloses that there were numerous German patents by means of which this product could be prepared from pentane. American manufacturers, facing the shortage of this material, and knowing that the requirements would be great, went into the gasoline market, and asked that special cuts be made so that they would be provided with sufficient pentane which they could utilize for the manufacture of this product. On account of the fact that the United States Government has been lax regarding exact disclosures in the patents granted, especially to Germans, it was necessary that American industry should employ skilled and competent chemists to endeavor to find a method by means of which amyl acetate could be manufactured at a reasonable cost and in sufficient quantities to meet present day requirements. The work required of American chemists was rendered more difficult on account of the confusion which arose over incorrect disclosures in the patents already granted than if there had been no published data regarding any processes whatsoever. The whole ground had to be worked over thoroughly and carefully. As a result of the work of these chemists a process was invented, a plant was installed, and quantities of material adequate for all present-day demands produced. The Du Ponts at Wilmington, Del., have had in operation for two years a plant for this purpose. The process consists essentially of taking natural gas-gasoline and subjecting it to fractional distillation. The fraction which distills over at from 40 to 70 deg. C., and which is essentially a solution of pentane and hexane, is brought in contact with chlorine in the presence of ultra violet rays of light, until a certain amount of chlorine has been absorbed by this fraction. This chlorinated mixture is then subjected to a washing and distilling operation. In the distilling operation a fraction is selected whose chief constituent is amyl chloride, or pentane in which one hydrogen atom has been displaced by one chlorine atom. This amyl chloride is then mixed with sodium acetate and the mixture heated under pressure. Common salt and amyl acetate are the products of the change which occurs. The separation of these two compounds is readily and easily effected. Amyl acetate has the following commercial uses—solvent for pyrocollodion, collodion, plotocotton and pyroxylene. Pyroxylene is used in the manufacture of artificial silk, imitation leather, waterproofing compositions, celluloid and photographic films. Pyroxylene lacquers and amyl acetate are used for metallic surface coverings.

The Demand for Fatty Acids

It appears to the speaker that the chemical possibilities of hexane, heptane and octane are even greater commercially than those of pentane. One of the greatest of the demands made upon American industry, and, in fact, upon world industry since the beginning of this great war, is that of fatty acids, i. e., acids which are derived by chemical changes more or less from vegetable and animal tissues. The supply from living sources has not

been equal to the demand, and industry, in order to meet the pressing requirements, has been compelled to look to mineral sources as a base of supply. Upon high authority the statement has been recently made, "It is not improbable that Germany to-day is supplying a large part of her fats from synthetic production, with mineral oils as a base of supply." It would be entirely foreign to a meeting of this general nature to enter into a detailed discussion of the changes which would be involved in the obtaining of fatty acids from these hydrocarbons of natural gas-gasoline, but it is not a dream or a product of the imagination when I state that it is entirely feasible by well-known and well-tested chemical reactions and methods of synthesis to prepare a fatty acid from these hydrocarbons that will have the same composition, same food value and same uses as the corresponding acid derived from natural fats. Numerous instances can be cited from scientific literature which will convince anyone of the correctness of this statement. To have made the statement ten years ago that gasoline was a potential force in supplying a part of the food requirements of the nation would have been regarded as fanatical and impossible.

Benzol Formed by Chemical Change Which Occurs When Coal Is Heated

Within the past year, many of the newspapers and most of the popular magazines have contained articles descriptive of the recovery from coal and coke-oven gas of benzol and toluol, and the manufacture from these substances of high explosives, important drugs and medicines, and a widely used coal-tar dye. These articles have appeared as a result of a desire on the part of the American people to learn of the demands which are being made upon American industry by the nations at war. Germany had formerly supplied practically the entire world with these substances, and when the German supply had been cut off, such a demand had been created that it was necessary that some nation not at war provide ways and means of meeting these requirements. Plants for the recovery of benzol and toluol from coke-oven gas have been installed throughout this country with such remarkable rapidity and on such a colossal scale that American industry can to-day, if called upon, furnish the entire requirements of these materials for the world on a war basis. The scientific investigation which preceded and has gone along with the development of this great American industry, shows clearly additional chemical possibilities which natural gas-gasoline may have. The mother substance of all the so-called coal-tar drugs, medicines, explosives and dyes is benzol. Benzol does not exist as such in coal from which coal or coke-oven gas is derived, but is formed by the chemical change which occurs under definite conditions when the coal is heated. It has been conclusively shown by a large number of chemists that when coal is caused to undergo chemical change at low temperatures, benzol or aromatic hydrocarbons are formed. I have mentioned previously in this address that high-boiling paraffin petroleum distillates when heated to 500 to 550 deg. C. gave what is called "cracked" gasoline, and when heated to 650 to 750 deg. C. gave aromatic compounds. The speaker has personally conducted experiments with propane and butane and the gasoline hydrocarbons under varying conditions of temperature in the presence of catalysts like nickel and iron, and found that benzol and toluol can be prepared from them. It seems therefore quite clear that if the proper time, attention and thought were put upon the problem, that a commercial process, economical and satisfactory, could be devised, whereby the hydrocarbons composing natural gas could be converted into benzol and toluol, or, in other words, if necessity required, natural gas-gasoline could be made the basis of the coal tar, drug, medicine, explosive, and dye industries.

Heavy Hydrocarbons

It has long been noticed in the operation of absorption gasoline plants that there were heavy hydrocarbon vapors that were not condensed at atmospheric pressure by the condenser directly connected to the stills in the distilling operation. Early in the industry, these vapors were permitted to escape, either into the air or were passed into a low-pressure fuel line. Later on these vapors were collected and handled in a small compressor, and as a result of the compression and subsequent cooling, considerable yields of high gravity gasoline were secured. This practice is now a general one in absorption gasoline plants. The uncondensed gases from this tail house compressor have for the most part been either put into suction lines or into fuel lines. In some few instances, the compressor which is used on these vapors is a two-stage one, in which pressures of from 100 to 150 lb. are maintained on the discharge. When such compressors are used, the product produced in the second stage of the compression, or in the low stage if the pressure is above 50 lb., contains highly volatile liquid. If the liquid produced under such circumstances is trapped or blown off into run or storage tanks, the product undergoes weathering, which means nothing more or less than that the material is permitted to remain in the tanks until the highly volatile portion has evaporated. In the majority of these cases the weathering or evaporation products are permitted to escape into the air. This practice has been nothing more or less than criminal waste, for every producer of natural gas-gasoline has known that under no circumstances can this material be delivered to market in ordinary tank cars, and that although he has spent his money for equipment and power in producing it, he has received no financial return from it. It seems incredible that the commercial possibilities of extracting liquid by-products should have been unnoticed for so long a time.

Value of Butane Constituents

As the natural gas-gasoline industry developed and its possibilities become well known, leaders in the natural gas industry, as a result of their studies in determining the best conditions of operation of gasoline plants, realized that there could be extracted from natural gas other by-products of a liquid nature, which were too highly volatile for use and shipment as gasoline. Recent discoveries have disclosed the utility and value of the propane and butane constituents of natural gas when they are substantially free from other constituents of the gas. A process has been devised for the recovery of these two substances in liquid form along with the recovery of gasoline from natural gas. The plant which will produce these two substances is made as an adjunct to the absorption gasoline plant. It can be

easily and cheaply installed, and can be operated with very low operating cost as the operating conditions require no additional attention other than that which the men regularly employed on a gasoline plant can give to it without neglecting their other duties. One plant has already been installed for the manufacture of both liquid butane and propane. Since May 31, 1917, it has been possible to produce at this plant approximately 2,200 gal. of liquid butane and 2,000 gal. of liquid propane per day.

In practicing the process for the recovery of substantially pure liquid butane and liquid propane, the by-product vapors from the condenser consisting of a mixture of propane, butane, some pentane, hexane and fixed gases are passed under pressure under a definite set of conditions through an absorbent oil. This treatment is for the purpose of removing petane and hexane. The remaining vapors—substantially a mixture of propane and butane, are, under a given set of temperature conditions, subjected to pressure. This results in the condensation of a highly volatile liquid product from which liquid butane is commercially produced. The remaining uncondensed propane vapor is again subjected to a compressing and cooling operation, and a liquid portion is obtained, from which substantially pure liquid propane is obtained. The products as obtained by the process thus briefly described have the following average physical properties:

Liquid butane is a clear, colorless, mobile liquid with a gravity of 106 to 108 deg. B. at 32 deg. Fahr.; it has a heating value of about 3,400 B.t.u. per cubic foot. One gallon of the product when evaporated produces 37 cu. ft. of vapor when measured at 60 deg. Fahr. and atmospheric pressure. The gravity of the gas or vapor produced varies from 1.98 to 2.02, air equalling 1. The boiling point of the liquid at atmospheric pressure varies from approximately 29 to 34 deg. Fahr. The following temperature-pressure relations, when this product was confined in a steel cylinder, were found:

Degrees Fahr.	Pressure Gauge
44	55
60	65
71	83
81	98
92	112
103	129

Latent heat of evaporation at 1 atmosphere and 32 deg. Fahr. = 164 B.t.u. per pound.

Liquid propane is a clear, colorless, mobile liquid, gravity 128 to 131 deg. B. at 32 deg. Fahr. Heat value, 2,600 B.t.u. per cubic foot. One gallon of the product upon evaporation will yield 45 cu. ft. of gas or vapor at 60 deg. Fahr. and atmospheric pressure. The gravity of the gas produced is 1.51 to 1.54. The boiling point of the liquid at atmospheric pressure is approximately 49 deg. Fahr. The following temperature-pressure relations, when this product was confined in a steel cylinder, were found:

Degrees Fahr.	Pressure Gauge
47	438
59	453
70	470
81	500
91	524
100	555

Numerous practical and engineering tests have been made on both of these products. They have been found suitable for the lighting and heating of homes and buildings in regions remote from the gas fields. The ordinary commercial appliances in the way of burners and stoves have been used in these experiments. The readjustments which have been required in these common devices for the economical and satisfactory use of those products have been learned. Tests have been made with those gases as a source of power for stationary engines and automobiles. In the work of adapting these products for motor fuel purposes, the speaker has had the hearty co-operation of Drs. Raymond F. Bacon and Harry Essex, of the Mellon Institute, and Mr. Barber, an experienced internal combustion engineer. The results of the work carried on clearly indicate and prove that not only can those substances be used with the ordinary equipment of internal combustion engines, but that the carburetor can be entirely done away with, and in its stead a gas mixer be used. The following road and maximum power tests will be of considerable interest:

RECORD OF ROAD TEST USING BUTANE AS FUEL JULY 9-10, 1917

Machine	Crawford 45 hp., using gas mixer in place of carburetor.
Weight	Empty 3,750 lb., loaded 4,750 lb.
Run consisted of	21 miles Pittsburgh city driving, 111 miles country-mountain driving.
Location of run	From Pittsburgh to the east side of Laurel Ridge (beyond Ligonier, Pa.) and return.
Gas supply	In three cylinders, containing 78 lb. of butane.
Total gas used	58 lb.
Total mileage	133 miles.
Miles per pound	2.3 miles.
Miles per gallon	11.5 miles.
Adjustments made	70.
Connections made	21.
Stops to change tanks, etc.	40.

Note.—Each stop necessitated readjustment and large loss of gas—unnecessary with proper tanks and purest gas.

COMPARISON WITH GASOLINE

The same Crawford car, equipped with Stromberg carburetor, on the same run with three stops gives 9.3 miles per gallon of 76 deg. gasoline.

With forty stops, and the same number of adjustments, the mileage would be less than 5 miles per gallon of gasoline.

In addition to this excellent mileage shown, the oil requirement was cut over 50 per cent. But 1 quart of oil was put into the system and not over ¾ quart used. Ordinarily with gasoline on this run, 2 quarts are necessary.

REMARKS

The run as recorded above was made on a very bad day. Rain fell hard for at least four of the ten hours' time and the air temperature was from 52 to 60 deg.,

giving little chance for gasification by heat; also the roads were necessarily slippery.

The engine at no time failed to give the proper mixture and could be throttled down to 5 miles per hour on a 12 per cent grade without stalling or missing a single explosion. This cannot be done with any four-cylinder car using gasoline.

In the maximum power tests which were conducted at the Mellon Institute, a Dodge motor was used. Various fuels were tested, and the total horsepower developed by all the fuels used did not vary from one another more than 1 per cent, or easily within the limits of experimental error. Carburetor adjusted and spark advanced to maximum power. The temperature of the exhaust gases varied from 640 as a minimum to 655 deg. C. as the maximum.

In our work with the stationary engines, we have found that 1 cu. ft. of propane is equivalent to almost 2¼ ft. of ordinary natural gas, and that 1 cu. ft. of butane is equivalent to approximately 3 cu. ft. of ordinary natural gas. This is the relationship which could have been anticipated from the relative heating values of the different products. In addition to the uses cited above for these by-product liquids, other important uses have been discovered and appliances for their satisfactory use commercially devised, namely, for the purpose of the cutting of metals and of incendiary bombs for offensive warfare work. The latter one of these uses will be omitted from the discussion of this paper for obvious reasons.

Fuel for Metal Cutting

The credit for working out the details of the torch used for metal cutting is due to James and Harry Anderson, of the N. C. Davisson Burner Company. Liquid butane and liquid propane have both been successfully used by these same gentlemen for the welding of cast iron, aluminum and other metals. Work is in progress which has for its purpose the development of a torch which will enable these materials to be used for steel welding. The speaker has every reason to believe that this torch will soon be available for sale on the American market. In accordance with the Interstate Commerce Commission specifications No. 6 for shipment of liquefied petroleum gas of not over 150 lb. charging pressures, cylinders may be used which are seamless, or of welded or brazed construction, and must show a test pressure of 600 lb. Butane does not require 150 lb. charging pressure. It is therefore possible to ship liquid butane in accordance with these specifications in cylinders which will weigh from one-eighth to one-third that of the cylinders now used in interstate commerce shipments of gases which are used for similar purposes. This gives butane a marked advantage in freight and express shipments. In addition, the cost of these cylinders should not be in excess of 40 per cent of the other cylinders which are in use commercially.

Another added advantage in the use of butane is its remarkably narrow explosive range. The following may be of interest with reference to the explosive limits for mixtures of various commercial gases:

	Per cent of gas
Natural gas	5.0 to 11.5
Methane	6.1 to 12.8
Coal gas	7.9 to 19.1
Acetylene	3.3 to 52.3
Hydrogen	9.45 to 66.4
Butane	3.0 to 8.0

It is clear from the above that butane is the safest to use of all commercial gases.

It is apparent from the above program that there are tremendous possibilities from the recovery and therefore the use of these liquids, highly volatile products of natural gas. A discussion of other possibilities of these substances is deferred to another section of the address.

Chemical Changes Which Natural Gas, as a Mixture, or Its Constituents Separately Will Undergo When Subjected to Heat

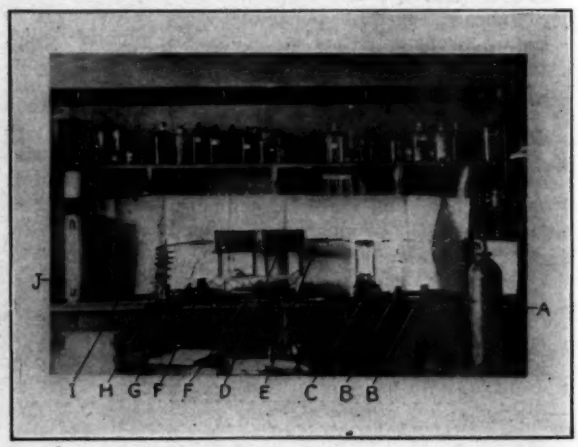
Early in October of 1915 the speaker, in connection with his assistants, began a preliminary study of the effect of heat on natural gas.

They made use of electrically heated fused quartz or Shelby steel tubes. Experiments were made both in the presence and absence of catalysts and the influence of these substances on the decomposition under temperature ranges of from 400 to 1,400 deg. C. studied. The catalysts used were pumice-nickel, pumice-copper, charcoal, finely divided copper, finely divided iron; aluminum, aluminum chloride, and silica. It was found that the decomposition, whatever took place in the presence of these catalysts, varied in a manner that was characteristic for each catalyst. For example, one catalyst, under a definite set of conditions, gave a high percentage of acetylene while another produced none.

There has been quite a lot of work done on the thermal decomposition of the paraffin hydrocarbons, but as far as the speaker is concerned he is not aware of the industrial application of the results of the majority of this work. The patent, scientific and technical literature contains much information relative to the subject.

In the experimental work which the speaker did the following products were used: (a) Natural gas as is delivered to the city of Pittsburgh; (b) vent tank gas; (c) propane, and (d) butane.

All of the samples of these gases were carefully analyzed and tested and their properties tabulated. The gases were then caused to pass through the apparatus provided for their study under varying conditions of



temperature, pressure and rate. The accompanying photograph shows the apparatus employed.

From the accompanying illustration it will be observed that the apparatus consists of the following parts:

(a) A steel cylinder in which the gas to be studied is confined.

(b) Wash bottles which contain a liquid to indicate the rate at which the gas is passing.

(c) An apparatus which determines the exact amount of gas passing per minute.

(d) An electrically heated furnace.

(e) A tube in which the chemical changes take place.

(f) Rheostats.

(g) A pyrometer for accurately measuring temperatures in the furnace.

(h) A coil condenser for the separation of liquids, tars and solids.

(i) A discharge gas tube.

(j) A calibrated cylinder for the collection over water of the discharge gas so that its volume, composition and properties can be studied.

In order that this address may not be made tedious by the introduction of tabulations of results these have been omitted and will be published subsequently in a scientific and technical journal. It is sufficient, upon this occasion, to state that the experimental results were most gratifying in that the conditions of experimentation were learned whereby natural gas found chemical changes when subjected to heat under varying conditions. Carbon black, unsaturated hydrocarbons, of both the olefines and acetylene series, and hydrogen are the direct and only products which are obtained when one set of conditions is observed, while on the other hand, when another set of conditions is observed, in addition to the products mentioned, benzol, toluol, naphthalene, etc., are produced.

Industrial Application of Results

The industrial application of the results of our experimental work has, so far, been confined to that set of conditions which had for its purpose the production of the greatest yield of the highest quality of carbon black. In the two plants which have been built the following are the representative results:

Kind of Gas	Ratio of Gas Passed to Gas Collected	Carbon Black Formed Lb. Per 1,000 Cu. Ft.	B.t.u. of Discharge Gas	B.t.u. of Inlet Gas	Per Cent Unsaturated Hydrocarbon
Natural gas.	1.27	4.52	840	1,142	6.75
Vent gas ...	1.42	6.44	861	1,347	12.9
Propane ...	2.63	26.9	866	2,600	26.2
Butane	2.99	38.2	702	3,400	26.6

It will be observed, first, that natural gas, as a mixture, gives a yield of carbon black three times as high as that usually obtained by the wasteful process of incomplete combustion, and that the yields from the other gases are far in excess of those obtainable from ordinary natural gas.

Second.—That the discharge gas is larger in volume than the inlet gas by ratios varying from 1.27 to 2.99. The heating value of the discharge gas is of necessity much lower in value than the inlet gas; however, the discharge gas has a heating value much superior to that of any artificial gas. The discharge gas is therefore a commercial one, and if carbon black is the only product desired this gas can be put into the usual channels for delivery to market.

Third.—That the discharge gas contains unsaturated hydrocarbons of the olefine series, mostly ethylene, and that the amount varies from 6.75 to 26.6 per cent. The olefine hydrocarbons are present in artificial gas, and in a large measure are responsible for its luminosity. If it is desired these unsaturated hydrocarbons may be used by simple chemical reactions for the manufacture of:

(a) Glycols.

(b) Industrial alcohol, acetaldehyde, acetic acid, acetone.

(c) Chlorinated olefine solvents.

It is well known in organic chemistry:

1. That members of the olefine series of hydrocarbons when treated under the proper conditions with potassium permanganate yields glycols.

2. That olefine hydrocarbons when treated under the proper conditions with sulphuric acid yield compounds which on treatment with water give alcohols and regenerate the sulphuric acid.

3. Olefine hydrocarbons when treated directly with chlorine absorb the chlorine chemically and yield chlorine derivatives.

The glycols are, as a general rule, thick, colorless liquids and have a sweet taste. They are miscible with water and alcohol in all proportions. Recently these substances have been utilized as substitutes for glycerin in the manufacture of medicine, drugs, explosives, etc.

The extensive commercial use of alcohol is too well known to need much discussion. The largest commercial uses of industrial alcohol are for solvent purposes. In the manufacture of organic dyes, varnishes, explosives, perfumes, tinctures, etc. Since the opening of the European war large demands have been made upon the alcohol industry for ether, acetaldehyde, acetic acid and acetone. All these substances may be obtained by simple well-known chemical reactions from industrial alcohol.

The chlorinated olefine derivatives have for the past few years been made in large quantities by other methods and have found extensive use in the rubber industry.

I have pointed out above that carbon black and olefine hydrocarbons can be produced from natural gas or its constituents separately. I have further pointed out the chemical possibilities of the olefine hydrocarbons. If both carbon black and olefine hydrocarbons are recovered from natural gas and utilized in any of the ways mentioned above there is left a residue mostly composed of hydrogen. This residue can be easily converted into a practically pure product by subjecting it to heat at a temperature slightly in excess of 1,400 deg. C. The opportunity therefore is open for the manufacture of pure hydrogen from natural gas. Hydrogen, as is well known, is used largely in war times for balloon purposes; however, its largest peace-time use is in the hydrogenation or hardening of oil. Tremendous quantities of cottonseed and other edible oils are readily converted by means of hydrogen in presence of nickel as catalyst into solid products or fats which have wide economic and industrial importance.

(*Continued on page* 505)

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Setting Down From Future Study the Lessons We Are Learning Today

Throughout the country we are applying gas to industrial tasks that few ever thought of it in connection with in the past.

How many of these interesting and unique installations are going to be known of outside a very limited circle? The things we are doing to-day and the lessons we are learning thereby should be the property—the assets—of the whole gas industry.

Countless installations, doubtless, could be sold in the future on the basis of what we are doing to-day.

The industrial fuel gas man owes it to his fellows and to his industry to add to his already considerable tasks, that of writing descriptions, for their benefit, of what he is now doing.

The Employee Smith

The old-fashioned manager couldn't stomach Smith. Neither could he fire him. The fellow had a habit of producing results in his department, though the old-fashioned manager couldn't see how he got them except, perhaps, through luck.

Smith never did any work himself so far as anyone could detect. He had a desk, it is true, and sat for hours behind it, though there was seldom anything more than a memorandum pad on it.

He didn't dictate a dozen letters a day, though a hundred or more went out in the evening's mail with his signature at the bottom.

Smith never perspired or looked ruffled. He did a whole lot of talking during office hours, but it couldn't have been on very deep subjects, as there was almost always a smile on his lips.

Not only would he be out two and three hours to lunch, but he'd usually have a subordinate with him; for company, the old-fashioned manager thought.

But Smith got things done, and his department produced results. His stenographer wrote his letters from a scrap book. All Smith would give her was the address and a few numbers representing paragraphs. They must be, of necessity, cut-and-dried affairs, the old-fashioned manager thought, but they "pulled"; and they smoothed over "kicks."

There was more individualism in Smith's department than in all the rest of the gas company combined. Inquiries that in other departments would be referred to the head, even the office boy in Smith's department answered offhand. Smith apparently did not permit himself to be troubled with matters pertaining to mere business.

The old-fashioned manager's idea of a deserving employee was the one who literally "earned his bread by the sweat of his brow." The manager should be, in his estimation, if only for the sake of example, the hardest worked individual in his department.

That was another drawback to Smith. Not only did he take it easy himself apparently, but everyone else about him had the same unhurried air. No one worked apparently, but the department provided results nevertheless.

No, the old-fashioned manager couldn't see anything to Smith as a deserving and diligent employee. But the results were there; he couldn't fire him. And when the year ended he raised his salary. He couldn't really make Smith out, and in the meantime he didn't want to risk his quitting through dissatisfaction with the company There might be something to the fellow after all, and he might be hard to replace. In the final analysis, results count.

The Difference

We alluded some weeks ago, in these columns, to the small amount of assistance in the way of national publicity, through advertising in popular magazines and periodicals, the gas company receives from the manufacturer of gas lighting equipment.

A recent issue of *Electrical Merchandising* brings this matter back forcibly to our minds. Several big-space advertisers in this issue, addressed to dealers of electrical appliances, dwell especially on the assistance they give the dealer in the way of popular advertising.

It is a selling point for their product—that is why they play it up so strong.

All other things being equal, the electrical supplies dealer selects the appliances that he has the least difficulty in selling, the appliances that have already been made known to his prospects through advertising in mediums they read.

It is not a new wrinkle. It is being used in shoes, in groceries and what not, except gas.

Yet we hear the inquiry repeated, time after time: "What's the matter with the gas man; why doesn't he sell more gas lighting?"

The gas lighting manufacturer answers readily: "Lack of free maintenance," "Incompetent and underpaid salesmen," "Hypnotized with industrial business," etc.

Most of his answers are based on facts. For that reason they are absorbed and the gas man forgets that he has evaded the important reason: That the power of intelligent national publicity—a power beyond estimate—has all been directed against or away from gas lighting rather than in favor of it.

The AMERICAN GAS ENGINEERING JOURNAL does not take the position that any one or two manufacturers of gas lighting equipment should immediately set aside vast sums to plunge into this work. That would be merely to profit the shirker manufacturer who stands apart. It should be a co-operative effort on the part of all manufacturers of "quality" gas lighting equipment. The manufacturers of unreliable and worthless equipment should be kept out of the circle and the gas companies should keep them out of the order books.

With adequate publicity and "quality" merchandise exclusively, selling gas for lighting should be about the easiest thing there is in the way of gas merchandising.

Publications

How to Save Coal

Paper-bound pamphlet; 20 pages; illustrated; 8 x 10½ in. Published by Bailey Meter Company, 141 Milk Street, Boston, Mass.

Some pertinent suggestions as to how to obtain the best results from boilers with a minimum of coal, and as to how the equipment of the publisher—his Bailey Boiler Meter—will assist in so doing.

Initial Priming Substances for High Explosives

Technical paper 162 of the U. S. Bureau of Mines, Van H. Manning, director. Paper backs; 9 x 6 in.; 32 pages, illustrated. Obtainable from U. S. Bureau of Mines, Washington, D. C.

In order to insure effective action by high explosives, or explosives of the second order, it is necessary to use a detonator. As most of the technically useful blasting explosives and all the permissible explosives used in coal mines are explosives of the second order, an exact knowledge of the theory and practice of initiating their explosion is highly desirable. Misfires frequently cause accidents, and many misfired and incomplete detonations of explosives result from the failure or the ineffectiveness of the detonator. The Bureau of Mines is frequently asked to investigate such difficulties, and is constantly testing and analyzing detonators. Besides making these practical tests, the Bureau is to investigate the properties of initiating substances.

The course that an explosive reaction may take is influenced by the character of the initial impulse imparted to the explosive and also by the nature of the explosive itself. In other words, the effect produced by an explosive in practice depends not only on the explosive, but also on the primer used to set it off.

Practically all detonator compositions used in this country have as their essential ingredient fulminate of mercury. Heretofore, the most common method of varying the character of the primer has been that of varying the weight of the fulminate mixture in the copper shell; that is, by using stronger or weaker detonators. Recent investigations have shown that there are primers more efficient than mercury fulminate mixtures.

The work is a discussion of the development of primers for high explosives, theories of action of initial primers, work of other investigators, results of experiments, and of theory advanced.

A Handbook of Piping

Author, Carl L. Svensen, assistant professor of engineering drawing, Ohio State University. Cloth bound; 9 x 6 in.; 360 pages; illustrated. Published by D. Van Nostrand Company, 25 Park Place, New York City. Price $4 net.

An able handling of a subject on which comprehensive information in as concise form as the subject will permit is very much needed. Though the space devoted to gas piping is not as extensive as we think this branch would justify, there is presented so thorough a discussion of the whole piping problem as would recommend this volume to a place on the shelves of every gas company.

There are many things which every engineer is assumed to know about piping, but the sources of such information are not always so readily available as to justify this assumption. In designing some pieces of work requiring the use of piping, the designer has often been under the necessity of searching through collections of catalogs, handbooks and even fittings themselves, perhaps without finding the details desired. The inconvenience and loss of time resulting from the lack of a ready source of information regarding the use of pipe and its accessories would seem to justify the publication of a book devoted to it.

This work is offered for the purpose of supplying in convenient form information and data regarding piping, fittings, pipe joints, valves, piping drawings, and pipe lines and their accessories. It is hoped that the variety and extent of the tables, illustrations and formulæ will be sufficient to make it of value to both engineers and students. The tables have been prepared with care, and are all uniform in arrangement, to facilitate their use. In the case of tables of sizes the names of the different companies have been given, which it is believed will add to their value. A list of books and references is given in Chapter XIX with a view to extending the usefulness of the work.

Various authorities have been consulted, and no claim for originality is made for the substance of the information thus obtained, but it is hoped that the form of presentation will commend itself.

A Bibliography of Municipal Utility Regulation and Municipal Ownership.

Volume IV of Harvard Business Classics. Author, Dan Lorenzo Stevens; 410-page volume; cloth backs, 9 x 6 in. Published by the Harvard University Press, Cambridge, Mass. Price $4.

Compiled primarily for busy men of affairs—public service company managers, commissioners, lawyers, and others interested in public utilities—this list makes available nearly every recent work in English on these subjects and the best of the earlier ones. The subjects treated are electricity, gas, water and traction utilities.

In making a choice of material to be included and the form of presentation, the decision has been based upon the needs of the busy man of affairs. That the expert and the general reader alike may be served, all readily accessible books and signed articles of more than transitory interest have been listed. Free use of annotations, together with a detailed subject classification, will serve to guide the reader to the works best suited to his needs. Official publications are included only if especially valuable, but references to other sources of information are given in the list of bibliographies. Works in other languages than English are omitted. Electric, gas, water and traction utilities are covered, and it is believed that little of value on the subjects treated has been overlooked. Owing to the rapid changes in the methods of regulation during the last decade, nearly all of the recent but only the best of the earlier material is included. The work has been brought down to Jan. 1, 1917.

As no one person could pass expert judgment on so many subjects, the critical annotations are intended to indicate *relative* value only. Not all people will agree with the author's comments on the various works, but the annotations are only intended to facilitate a selection of material. The tile and annotations, together with the subject classification, indicate quite closely the nature of each book and article.

United States Steel Corporation's Methods for the Technical Sampling and Analysis of Gases

Paper-bound booklet; 60 pages, illustrated; 9 x 6 in. A second edition, revised by the following committee: W. D. Brown, chemist, Duquesne Works, Carnegie Steel Company; Dr. J. R. Harris, chemist, Tennessee Coal, Iron & Railroad Company, and J. V. Freeman, chemist, Central Laboratory, Joliet Works, Illinois Steel Company.

A standard system of sampling and analysis of gases so that comparable results may be obtained by all the works of the corporation. It was prepared by reviewing the practices of all the company's laboratories that have such work to do.

In the preparation of the standard methods devised, the purpose has been to eliminate as far as possible tedious analytical procedure and the use of cumbersome forms of apparatus. No notable originality is claimed for the work, but it is believed that the application of well-known methods, coupled with certain novel features in execution and in the forms of apparatus used, are presented.

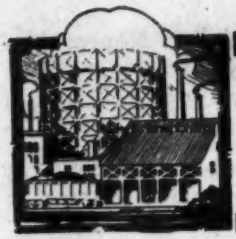
The method of sampling given is general, as it was recognized as impossible within the scope of the pamphlet to give a detailed method of sampling gases that would be practical to all the works of the corporation and the various manufacturing operations therein.

The kinds of gases dealt with include auxiliary gas, blast-furnace gas, producer gas, by-product gas, flue gas and natural gas.

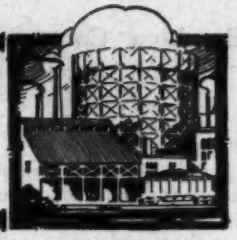
Several pages are devoted to useful tables.

30,000 Tons of Graphite Will Be Required for Crucibles in 1918

About 30,000 tons of graphite suitable for crucible manufacture will be needed in 1918, according to the U. S. Geological Survey. If freight and market conditions and an improved labor situation favor the shipment of domestic graphite about 8,000 tons of flake of crucible grade, exclusive of dust, can be marketed in this country in 1918, an increase of more than 100 per cent over the production in 1917. If the freight conditions that prevailed in the autumn of 1917 should recur the domestic production of No. 1 and No. 2 flake will hardly exceed 2,500 tons. If the domestic production could be stimulated to its maximum capacity, reasonable assurance of a steady market given, and encouragement offered to new plants a production as high as 12,000 tons might be reached. The situation is more favorable with respect to non-crucible graphite. The requirements for 1918 will be between 28,000 and 32,000 tons, which may probably be supplied by domestic, artificial and Mexican production.



NEWS OF THE GAS INDUSTRY



Tacoma Company Employees Donate Half of 1 Per Cent of Pay for Soldiers

A letter received from W. A. Leuenberger, general manager of the Tacoma (Wash.) Gas Company, says:

"The regular employees of our company about three months ago started a soldiers' tobacco fund, each employee agreeing to donate one-half of 1 per cent of his pay, which is deducted from the pay checks and which is used to purchase smileage books and tobacco for our boys."

Ironwood Plant Is Ordered Sold

On petition of the Union Trust Company, of Detroit, the Gogebic County Circuit Court has ordered the plant of the Ironwood Gas Company sold at foreclosure. The Detroit concern has been trustee for the plant for more than a year and has advanced over $12,000 to meet overdue obligations. The plant is bonded for $202,000. First mortgage bonds total $22,000, and there is an issue of $180,000 of second mortgage bonds.

Fargo Output Increased 28.2 Per Cent for Week Ending May 10

The gas send-out of the Union Light, Heat & Power Company, Fargo, N. D., for the week ended May 10 was the greatest in the history of the company, being 28.2 per cent larger than the corresponding week of last year.

Wichita Falls Plant to Discontinue Service June 1

After June 1 the Wichita Falls (Tex.) Gas Company will discontinue business, Manager J. W. Culbertson announced recently. This is made necessary by the fact that the company's wells are failing to produce half of the gas consumed locally and by the announcement of the Lone Star Gas Company that following June 1 it cannot supply the company with gas from its wells at Petrolia.

The Chamber of Commerce will ask the city council to call an election for the people to decide whether the North Texas Gas Company can buy the Wichita Falls Gas Company's property, pipe line and other equipment.

Increased Rate for Norwich, Conn.

The City of Norwich (Conn.) Gas and Electrical Department announces that commencing June 1 the price of gas furnished by the department will be as follows:

Up to 30,000 cu. ft. per month, $1.50 per 1,000. The present price is $1.25.

Thirty thousand to 150,000 cu. ft. per month, $1.30 per 1,000.

All over 150,000 cu. ft. per month, $1.15 per 1,000.

No bills will be rendered, however, at a less amount than that which is calculated for the maximum amount at the rate of the preceding block.

In making the increase the commissioners say they have given the matter careful consideration and find that, because of the excessive increase of the cost of labor and all material entering into the manufacturing of gas, it is impossible to sell the product at the present price.

The commissioners also say that they hope the increase will be only temporary, for as soon as the conditions warrant the price will be reduced.

Next Winter's Coal Supply a Vital Question At Southern Gas Association Convention

Service Flag Presented At First Day's Session—Those in Attendance Look Over Enemy Internment Camp—Seventy Five Members Present

Seventy-five members of the Southern Gas Association met at Chattanooga, Tenn., May 22, in their annual convention.

An interesting feature of the proceedings was the presentation to the association of a service flag showing that twenty-three members of the organization now are with the colors. The speech of presentation was made by R. J. Ralston, of Philadelphia, in behalf of Mr. and Mrs. R. L. Marquis, of Birmingham, Ala. The flag is the work of Mrs. Marquis.

Mayor Jesse M. Littleton, of Chattanooga, delivered an eloquent address of welcome to the delegates. This was followed by the address of the president, F. L. Marshall, of Augusta, Ga., and an elaborate paper on "Surface Combustion" was read by Mr. Evans, of Long Island City.

The report of the committee on public relations was submitted, but discussion and action was postponed until the second day. Numerous members of the association engaged in a lively discussion of the difficulty of securing coal, and the consequent hardships on public utilities and consumers. The lack of coal next winter, it was pointed out, threatens the very existence of many public utilities and therefore the welfare of the whole country. No action was taken on this question, but all the talks urged the necessity of proper Government action to avert the threatened danger.

Scores of the delegates in the afternoon made a trip to Chickamauga Park and had a good look at Fort Oglethorpe, the German internment and war prison barracks, and other points of interest. In the evening a dinner was given at the Hotel Patten, and this was followed by a dance.

Brooklyn Company Granted Rehearing on Bond Issue

The public service commission granted a rehearing to be held May 20 at 2.30 on the application of the New York & Richmond Gas Company for authority to execute a first refunding mortgage and to issue thereunder $2,214,400, of which $1,500,000 is to be used for refunding purposes and $302,284 is to reimburse the treasury for money expended for extensions and betterments.

The commission denied the application on Feb. 1 last, because it was not satisfied that the expenditures made had been altogether for capital account. The matter is reopened now because the commission has ordered the company to extend its mains in the vicinity of New Dorp and Grant City, Staten Island, and the company insists that it will need to raise the money on bonds.

Increased Rate for Rock Island

At a hearing before the Illinois Public Utilities Commission in Chicago recently the Peoples Power Company was granted an increased rate for Rock Island, Ill. The commission ruled that the rate be increased to $1 per 1,000 cu. ft. This is an increase of 15 cents, but is a temporary raise for the period of one year.

Councils of the tri-cities are given forty days in which to file objections to the increase. If during that time they can show the price of $1 to be exorbitant, the difference between the new and old price will be held in trust, to be paid back to the consumers.

State Engineer Little presented a report showing the actual cost of producing gas to be delivered at the burner at $1.05.

Las Vegas Company Requests Rate Raise

S. J. Lawson appeared before the board of city commissioners recently in behalf of the Las Vegas (Nev.) Gas Company and asked that the maximum rate for gas be raised from $2 per 1,000 cu. ft. to $3. Mr. Lawson stated that with oil at its present price and under the conditions which prevail locally, it would be impossible for the company to continue to furnish gas at the present rate.

Additional Companies on American Gas Association Membership List

In addition to the companies which were published in the May 18 issue of the AMERICAN GAS ENGINEERING JOURNAL, the following companies have also taken membership in the American Gas Association:

Consolidated Gas Company of New York, New York, N. Y.
New Amsterdam Gas Company, New York, N. Y.
The East River Gas Company of Long Island City, New York, N. Y.
Central Union Gas Company, New York, N. Y.
Northern Union Gas Company, New York, N. Y.
The Standard Gas Light Company, New York, N. Y.
The New York Mutual Gas Light Company, New York, N. Y.
New York & Queens Gas Company, New York, N. Y.
Westchester Lighting Company, Mount Vernon, N. Y.
Utica Gas & Electric Company, Utica, N. Y.
Crisfield Light & Power Company, Crisfield, Md.
Austin Gas Company, Austin, Minn.
Jacksonville Gas Company, Jacksonville, Fla.
Baton Rouge Electric Company, Baton Rouge, La.

MAUFACTURERS OF GAS APPLIANCES AND APPARATUS

American Meter Company, New York, N. Y.
Strait & Richards, Inc., Newark, N. J.
Sprague Meter Company, Bridgeport, Conn.
Crandall Pettee Company, New York, N. Y.
Lattimer-Stevens Company, Columbus, Ohio.

Princeton Utilities Company Wants to Purchase Consumers Gas Plant

The Princeton Utilities Company, of Princeton, Ind., has filed a petition with the public service commission asking authority to purchase the Consumers Gas Company, an artificial gas plant at Princeton, and to issue bonds to pay for the property. The Citizens National Bank, of Evansville, Ind., now owns the property to be purchased, having taken it over at a receiver's sale. A bond issue of $60,000 is outstanding against the property, and this the purchaser would assume, at the same time asking authority to issue $40,000 of new bonds, which are to be of equal priority with the former issue.

Barton Heights Representatives Approve of Increase

Favoring an increase in the gas rate by the Henrico County Gas Company, the committee representing the Barton Height (Va.) Association recently approved a resolution to that effect and ordered that it be sent to the city attorney. The resolution recites that an examination of the books of the company shows that it has been operating at a loss for several months, due to the higher cost of materials and labor. The increase is favored for one year.

Fuel and Railroad Administrations to Take Part in International Railway Convention

Representatives of the United States Railroad Administration and the United States Fuel Administration took a large part in the activities of the tenth annual convention of the International Railway Fuel Association, held at the Hotel Sherman in Chicago on May 23-24.

Major E. C. Schmidt, Ordnance Corps, and Eugene McAuliffe are in charge of the arrangements for the Fuel and Railroad administrations, respectively.

There was about 3,000 in attendance, including mine operators, representatives of the mine workers, railway executives and employees, Railroad and Fuel Administration representatives, and heads of industries which make large demands upon fuel and transportation.

New Tariff of Rates Effective June 1 Filed by Berwick Company

The Berwick (Pa.) Gas Company, operating in Berwick and Nescopeck, has filed with the public service commission a new tariff of rates, effective June 1, 1918, providing for a service charge of 30 cents per month for each meter in service. The tariff also increases the unit rates from $1 net for industrial power service and $1.25 for domestic fuel and general consumption to the following schedule: First 20,000 cu. ft., $1.65 net per thousand; second 20,000 cu. ft., $1.55 net; all over 40,000 cu. ft., $1.45 net. The minimum rate of 50 cents per month is fixed.

Four Massachusetts Companies Granted Increase

Four companies in Massachusetts were recently allowed to increase the price of gas to the consumer for the duration of the war by the gas and electric light commission.

Arlington and Winchester gas consumers, served by the Arlington Gas Light Company, will pay $1.25 per 1,000 cu. ft. beginning May 1. They now pay $1.10.

The Plymouth Gas Light Company is authorized to charge $1.80 per 1,000 ft. The price is now $1.65. The company wanted to charge $1.95. The new price takes effect May 1.

The New Bedford Gas & Edison Light Company was authorized to charge $1 per 1,000 cu. ft. for gas. They have been charging 90 cents.

The Milford Gas Light Company was granted permission to raise its rates from $1.45 to $1.67. It asked for $1.75.

Rate Increase Application Filed by Fowler Company

The Fowler (Cal.) Gas Company has filed with the railroad commission an application for authority to increase its gas rates to meet its higher expenses, the increased cost of fuel oil, labor and other expenses. The gas company wants to increase the basic rate to $2.10 per 1,000 cu. ft. for the first 3,000 cu. ft., $1.85 for the next 4,000, $1.60 for all over 7,000 cu. ft. The rates are now $1.60 per 1,000 cu. ft. for the first 3,000 cu. ft., $1.35 for the next 4,000 and $1.10 for all over 7,000 cu. ft.

Junction City Council Raises Rates

An ordinance temporarily adjusting rates of the Junction City Gas Company to meet war conditions was adopted by the city commissioners.

The company, by the terms of the ordinance, is ordered to install new belt and lateral lines and other equipment necessary to supply an adequate amount of gas.

A minimum monthly charge of 75 cents is to be made for each meter installed where the consumer's bill is less than 75 cents.

The rate for gas is fixed at $1.50 per 1,000 cu. ft., with a minimum rate of $1.40 for patrons using more than 3,000 ft. of gas per month.

Ten cents per 1,000 cu. ft. may be added to consumers' bills not paid before the tenth of the month.

Best Means to Stimulate Production and Relief of Fuel Shortage Discussed at Thirteenth Annual Convention of Natural Gas Association

Companies Should Endeavor During Coal Shortage to Get Power from Commission to Compel Owners of Large Houses to Heat with Other Fuel than Gas

Tacoma Concern Secures Government Orders

The Griffin Wheel Works, of Tacoma, Wash., has received a Government order for 16,000 car wheels. The Northern Pacific & Milwaukee shops at Tacoma will build a large part of the 2,000 cars just ordered by the Government. A new 500-room hotel at Greene Park, Camp Lewis, will very likely install complete gas equipment for cooking and water heating, to be served by the Tacoma Gas Company. The number of troops in the National Army at American Lake cantonment near Tacoma will soon be increased to the maximum 50,000.

Windsor Locks Consumers to Pay 25 Cent Service Charge

The Northern Connecticut Light & Power Company, of Windsor Locks, Conn., will add a service charge of 25 cents to each of the consumers on and after May 1. The following notice issued by the company explains itself and the action taken by the company:

"We had hoped to avoid an increase in our charges for gas supply, but the operating expenses in our gas department have exceeded the revenue derived from the sale of gas for the past few months, and on account of the constant rise in prices of all material required in the gas supply service and the wages we are obliged to pay to hold sufficient men to enable us to render adequate service, we are compelled to increase our charges.

"Beginning with bills rendered May 1, a service charge of 25 cents will be added to each bill for gas, but the minimum charge of 50 cents per month will be abolished.

"As soon as prevailing prices warrant, we will reduce the rate for gas."

The thirteenth annual convention of the Natural Gas Association of America was held in the Chamber of Commerce Auditorium, Pittsburgh, Pa., May 22 and 23.

The meeting was called to order by the president, Joseph F. Guffey, who announced that to conserve time the address of welcome, the response and the president's address would be omitted. There were about 410 members in attendance.

The meeting was well attended, and many members entered in the discussion of the various papers presented.

The secretary reported that the association had 1,279 active members. Seventeen new members were elected as follows: George W. Bovaird, Bovaird Company, Bradford, Pa.; L. G. Bub, East Ohio Gas Company, Cleveland, Ohio; H. V. Couch, purchasing agent, United Natural Gas Company, Oil City, Pa.; Chas. M. Staigers, Winchester, Ky.; Wm. H. Whiteley, with Wm. G. Cummings, Pittsburgh, Pa.; H. M. Leathers, Cutler Hammer Company, Pittsburgh, Pa.; P. J. Morrissey, Johnstown Fuel Supply Company, Johnstown, Pa.; A. J. Fitzgibbons, A. M. Beyers Company, Pittsburgh, Pa.; Wm. G. Cummings, Pittsburgh, Pa.; F. D. Freeland, Peoples Natural Gas Company, Brane, Pa.; S. M. Gill, East Ohio Gas Company, Cleveland, Ohio; Wm. T. Kent, Tiona Gasoline Company, Brane, Pa.; F. D. Krum, Pennsylvania Gas Company, Erie, Pa.; R. A. McKinney, Manhattan Rubber Manufacturing Company, Pittsburgh, Pa.; Franklin Murray, B. F. Goodrich Rubber Company, Akron, Ohio; J. F. Owens, general manager, Muskogee Gas & Electric Company, Muskogee, Okla.; D. V. Peden, East Ohio Gas Company, Cleveland, Ohio.

After the secretary and treasurer reports for the year had been read and approved, a paper was presented

by Karl Emmerling, engineer, East Ohio Gas Company, Cleveland, Ohio, on "Auxiliary of Dual Installations for Domestic and Industrial Consumers."

The paper was discussed by several members, and practically all agreed that their great trouble was caused by some consumers using gas to heat very large houses, which caused such a shortage of gas in the cold weather that a large number of small consumers could not get enough gas to do their cooking or water heating. It was advocated that the companies endeavor to get power from the public service commission which would enable them during a period of shortage of gas to force the owners of large houses to heat with some other fuel, so that the smaller consumer would have sufficient for cooking and water heating.

It was strongly urged that the gas companies select the best auxiliary or dual heating apparatus and co-operate with their customers in every way to get them to install such apparatus, so that when the shortage of gas occurred in winter, they could easily heat with some other fuel for a few days or weeks until the stringency was over. The companies should not depend on dealers to supply this apparatus, but should start a commercial department for the benefit of both themselves and customers.

Samuel S. Wyer, Columbus, Ohio, read a paper on "Elimination of Discrimination in Natural Gas Rates of Readiness-to-Serve Charges."

In the discussion of this paper a variety of opinions developed as to the best way to make this readiness-to-serve charge, and the consensus of opinion was that it would have to be worked out by each company in each locality to fit the conditions existing there.

The afternoon session was opened with a talk by Dr. Israel C. White, State geologist of the State of West Virginia. Dr. White's paper was entitled "The Deepest Well in the World and the Next Deepest in America."

A. C. Bedford, chairman of the Petroleum War Service Committee, outlined the duty of the oil producers and pointed out how they could best co-operate with the Government during the duration of the war.

E. C. Weisgerber, of the Equitable Meter Company, Pittsburgh, has been appointed a captain in the Engineering Corps, and has left for camp to take up active duty.

Raleigh and Charlotte Consumers to Pay More for Gas

The North Carolina Corporation Commission approved the increase in the gas rate at Raleigh and Charlotte. The rate to be charged by the Carolina Power & Light Company in Raleigh will be increased from $1.50 to $1.60, and in Charlotte the Southern Public Utilities Company will increase the rate from $1.15 to $1.35 per 1,000 cu. ft. The increases were granted on account of increased cost of production.

Gas Rates Raised in Illinois Cities

Increased rates for gas were granted to the Illinois Traction Company in an order entered by the State public utilities commission.

Increases of from 10 cents to 25 cents per 1,000 cu. ft. for the first 5,000 cu. ft. of gas consumed monthly were allowed as follows: Decatur, 10 cents; Danville, 20 cents; Champaign and Urbana and Galesburg, 25 cents.

Citizens to Vote on Municipal Ownership of Omaha Gas Plant

Do Omaha people wish to buy the gas plant under present conditions? Without attempting to influence a single vote, either for or against the question, but in order that the people may vote intelligently on the proposition, the following information was published in a local newspaper.

The franchise under which the gas company now operates expires on Dec. 20, 1918.

When the board appointed reports its appraisal of the property the city council may abandon further proceedings by passing an ordinance to this effect. This can be done if the valuation is higher than expected.

On the other hand, if the gas company is dissatisfied with the appraised value, it can appeal to the district court, and thence to the Supreme Court, for more money. The city, also, has the right of appealing to the Supreme Court if the case in the lower court goes against it.

In the meantime, the city can take possession of the gas plant at any time after the appraisal is made by tendering the amount of the award. The gas company cannot take the plant back by any court proceeding, but can only ask the court for more money for the plant. The city retains the plant and must pay the price.

Upon final judgment, the city must issue bonds for the amount of the findings, and if the people refuse to vote on these bonds, the court will order the payment of the money just the same

Corporation Counsel W. C. Lambert, of the city of Omaha, said:

"It would seem safe to estimate that if the plant was taken over at this time it would cost the city at least twice as much as if taken over under normal conditions. If the plant is worth, under normal conditions, say, $3,000,000 to $3,500,000, it will cost the city now from $6,000,000 to $7,000,000 to acquire it."

The cost of gas to the people of Omaha will depend upon the price at which the plant is taken over.

New Oil and Gas Company Formed

Announcement has been made of the formation of the Victor Oil, Gas & Refining Company in Dallas recently. Dr. M. A. Cooper, of Childress, is president; E. G. Kemper, of Ennis, vice-president; Dr. G. R. Cooper, of Shreveport, general manager; J. W. Chism, of Hillsboro, sales manager, and Miss Fay Chism, of Hillsboro, secretary. The company is to be capitalized for $500,000.

The new company has holdings in the Caddo field in Louisiana and in the Burkburnett fields in Texas, having two producing wells in the new Pine Island territory. A 2,500-barrel well was recently brought in adjoining the company's property in the Caddo field.

Council Bluffs Company Gets Increased Rate

The Council Bluffs council recently agreed to an increase of 20 cents per 1,000 ft. in the price of gas furnished Council Bluffs, Iowa, consumers by the Citizens Gas & Electric Company.

The increase will become affective June 1, but at the end of one year the price is to automatically revert back to the old rate, whether the war ends or not. This arrangement is satisfactory to the company.

The new prices will be $1.30 minimum and $1.45 maximum per 1,000 ft. The present price is $1.10 and $1.25.

Clinton Company Adds $25,000 to Taxable Value of Plant

The Clinton (Mass.) Gas Light Company has by its officials notified the board of assessors of its willingness to have added to the taxable value of its local holdings the sum of $25,000.

Rate for Natural Gas in Kane Increased 5 Cents

The Kane (Pa.) Gas Light & Heating Company filed a new tariff of rates for the sale of natural gas, effective May 31, increasing the rate for gas to manufacturers and to public service corporations from 22 cents to 27 cents for 1,000 cu. ft., less 2 cents per 1,000 cu. ft. for prompt payment. The new tariff further provides that the company reserves the right to curtail or temporarily discontinue the supply of gas to manufacturing establishments when necessary to provide sufficient gas for domestic consumption or for public utilities.

Worcester Rate Hearing Set for June 10

June 10 has been settled upon as the date for the resumption of the public hearing before the Massachusetts Gas and Electric Light Commission on the proper price for gas manufactured by the Worcester Gas Light Company.

Increase Asked by Charlotte Company

Following an advertising campaign the New Charlotte Gas Company, Charlotte, Mich., has asked the city council for an increase in rates, it being desired that the present rate of $1.15 per 1,000 ft. be advanced to $1.30, because of increased cost of production and labor and present abnormal conditions.

Kings County Employees Have 100 Per Cent Record for Subscription to Third Liberty Bond

The employees of the Kings County Lighting Company, which supplies Bath Beach, Bay Ridge and Borough Park sections of Brooklyn, N. Y., have a 100 per cent record for subscription to the Third Liberty Bond. Ralph Elsman, general manager of the company, was enthusiastic when it was reported that the employees had shown their Americanism in such a concrete form.

Proposed Increase for Buffalo

The Buffalo Gas Company has announced an advance in rates from $1 to $1.45 net on artificial gas, the increase effective May 27, which is made necessary by a general increase in operating expenses.

The Buffalo Gas Company and the Iroquois Natural Gas Company are under control of the National Fuel Company.

The following reasons are given for the proposed increase of the Buffalo Gas Company.

1. An increase in the cost of labor, ranging from 50 to 100 per cent.
2. An increase in the cost of coal from $2.80 to $4.10 a ton.
3. An increase in the price of oil for gas-making purposes from 3¼ cents to 8 cents a gallon.
4. Corresponding increase in the cost of all materials entering into the manufacture and distribution of gas.

Increased Rate for Mason City

The Mason City, Iowa, council recently allowed the Peoples Gas & Electric Company to increase its gas rates. The rate is now $1.325.

Mt. Pleasant Company Seeks Increased Rate

The Central Gas Company, of Mount Pleasant, Mich., has asked the city council for a new franchise, claiming that the company could not furnish gas at the present rate of $1.25 per 1,000 cu. ft. without a loss.

Patience in Awaiting Deliveries

In sending out its "early ordering" publicity in the form of posters, motion-picture slides, four-minute speakers and appeals through the daily press, the United States Fuel Administration is adding to these an especial appeal to those ordering their coal early to await deliveries with patience. It is pointed out that it is obvious that the entire coal output of the country cannot all be delivered at once; but at the same time it is clear that no matter what the condition of the supply may be those orders which are on the books of the dealers will be filled prior to those received later in the year.

The State branches of the National Council of Defense are being asked to aid in this "early-ordering" drive, and the Fuel Administration believes that if the bulk of orders, both domestic and industrial, are in hand by July 1 there will result a marked improvement in railroad facilities, especially as by that time millions of dollars' worth of the new equipment ordered by the Director-General of Railroads will have come into use.

While particular pains are to be taken in this campaign to reach the domestic consumer in an effort to ward off any possible coal shortage in the homes next winter, it is plain that, after all, the greatest help toward the plans of the United States Fuel Administration must come from the large industrial consumers, who, by getting in early their orders for the bulk of the fuel their plants will need, can lend a tremendous impetus toward speeding up production at the mines and delivery that shall employ to the fullest all transportation facilities.

Gas Range Week in Indianapolis Proves Successful

Gas range week in Indianapolis and elsewhere in Indiana was a success, dealers say. Gas companies throughout the State and sellers of gas appliances made strenuous efforts to introduce gas-using into every home in their individual communities.

The newspapers boosted the plans everywhere. The gas utilities, of course, accented the week in their advertising, and such articles as the following kept the householder awake to the economies and other benefits of gas:

"Indianapolis gas appliance dealers are preparing to put this city on the map during this special selling week. Their windows will be decorated especially for the sales week and many campaigns for the widespread use of gas ranges will be conducted by sales forces.

"'It is as important to keep your kitchen modern as it is to dress up to date, is the admonition to the housewives, the dealers say, and cite the fact that there is no kindling to coax to burn, no coal to lug in these days when coal conservation is a factor in home life, no ashes to carry out, no

soot to blacken the walls, no hot stove to keep the kitchen hot for an hour after cooking.

"Trade epigrams fitly describe the advantages of the gas range and a few of them are, 'No more watchful waiting for cooks,' 'Lift kitchen work out of the rut,' 'Don't get down on your knees to any cook stove,' and many other catchy and clever slogans.

WILL DISCUSS RANGES

"Advantages of the gas range will be the topic among the gas appliance salesmen this week, as all sales efforts will be concentrated on the extension of gas range use during this six-day drive.

"Gas appliance dealers are offering special sales prices for the ranges this week. Widespread introduction of gas ranges is the purpose of the week's activities.

"Those interested in the national movement for gas range week have prepared various campaigns which are to be used for extending the public popularity for the gas ranges. Suggestions have been made for widely advertising the week among the housewives. Some will use contests for the best baked bread, cakes and biscuits on gas ranges, others will conduct prize essay contests for the school children, still others will have special advertising materials distributed by the meter readers and salesmen.

"Many advertising features will be used during the week to bring the importance and economy of gas ranges to the minds of the housewives.

"Each year is finding more and more users of gas ranges, it is said, and figures compiled by the gas appliance dealers show a certain economy in home upkeep by the use of the gas ranges. Gas appliances, dealers point out, solve many cooking problems."

Men Interested in New Gas Plant Entertained

A dinner was given at the Rochester Club on Wednesday evening, May 1, by officials and superintendents of the Rochester (N. Y.) Railway & Light Company, in honor of representatives of that company and the United Gas Improvement Company who were responsible for the construction of the new gas-manufacturing plant just completed on the west side of the river. Among the guests were Rollin Norris and J. H. Taussig, of Philadelphia, both of the improvement company. Herman Russell, assistant general manager of the light company, was toastmaster, and the speakers were Vice-President Robert M. Searle, Mr. Norris, Joseph P. Haftenkamp and Mr. Taussig.

Owing to Increasing Business Kompak Company Opens Additional Branch Offices

Owing to the remarkable increase in the sale of Kompak water heaters, the Long-Landreth-Schneider Company, New Brunswick, N. J., has established several agencies in the following States:

New York: 50 Church Street, New York City.

Pennsylvania: C. H. Ehrenzeller, Builders' Exchange, Philadelphia.

Connecticut: W. A. Devine, 25 Judson Avenne, New Haven.

Michigan: Western Rosin & Turpentine Company, Detroit and Bay City.

These are all in charge of special water-heater men prepared to cooperate with gas companies in the sale and maintenance of Kompak heaters.

Wonderful records are being made daily in shipments and sales. The special features of the Kompak appeal particularly to the commercial man who is trying to show a profit.

Columbia Gas Company Will Increase Rates and Reduce Discount

The Columbia Gas Company has posted notices in their office informing the public that beginning June 1 the rates will be increased from $1.40 per 1,000 cu. ft. to $1.50, and that after that date the discount for prompt payment will be 10 per cent instead of 15. Payment will be required in sixteen days instead of twenty to insure the discount reduction.

This action is taken by the company to meet the increased cost of production and the high price of materials, and consumers are notified that in case of unpaid claims in houses the reattachment will not be made until such are adjusted, and then at a minimum charge by the company of 50 cents in each case.

Rates Increased by Waterbury Company

The Waterbury (Conn.) Gas Light Company recently gave notice of an increase in its rates for gas, which was made necessary by the enormous recent increases in cost of materials entering into the production and distribution of gas. All bills rendered after June 1 will be at the following rates: First 10,000 cu. ft. per month at $1.20 per 1,000; next 40,000 cu. ft., $1.10 per 1,000; in excess of 50,000 cu. ft., $1 per 1,000.

Memphis Gas Rebates Bring $1,300 to Red Cross

Proceeds amounting to $1,300, resulting from a campaign carried on by the Memphis (Tenn.) Gas & Electric Company officials, who requested citizens to give a part of their rebates to the Red Cross, were recently turned over to Mrs. J. M. McCormack, of the Red Cross, by C. E. Chapin, of the company.

This amount will go toward the fund for the establishment of a Memphis ward in a hospital in Paris, France.

Increase Granted Southern California Company

The Southern California Gas Company has been authorized by the railroad commission to put into effect May 5 a new schedule of rates which will provide the company a net profit of 8 per cent on its investment. In its application the company contended that the existing rates failed to give a fair return, and were unreasonably low.

Haverhill Council Votes to Have Own Gas Plant

The first step in acquiring the plant of the Haverhill (Mass.) Gas Light Company was accomplished by the city council recently when two orders, presented by Alderman George W. Munsey, Jr., were taken from the table and unanimously passed.

One order was that the city be authorized to construct or purchase and maintain a plant for the manufacture and distribution of gas for furnishing light for municipal use and light, heat and power for its inhabitants. The other order was for the city to do the same. Similar orders must be passed next year to complete the matter.

Whole Natural Gas Industry To-Day Responsive to Problem of Chemical Possibilities of Natural Gas

(*Continued from page* 495)

It can thus be seen that by the decomposition of the natural gas or its constituents separately, valuable products can be obtained which have almost unlimited possibilities.

Chemical Changes Which Natural Gas or Its Constituents Will Undergo When Subjected to Chemical Change in the Presence of Other Substances and Without Catalysts

This section of the address will be limited to the discussion of the chemical changes which occur when natural gas, or its constituents separately, are treated with the following reagents:

(a) Air, oxygen being the active component.
(b) Chlorine.

(*a*) *Reactions with Air or Oxygen.*

The use of material gas as a fuel is nothing more or less than the taking advantage of the heat evolved when natural gas reacts chemically with the oxygen of the air. The chemical change which occurs results in the conversion of the paraffin hydrocarbons of natural gas into carbon dioxide and water. The formation of carbon dioxide and water is the final result of a whole series of intermediate chemical changes. It is to these intermediate chemical changes that I desire to call your particular attention at this time. Considered from the theoretical viewpoint, methane, the predominating component of natural gas, should yield, when treated under the proper conditions with air or oxygen, the following substances: Methyl alcohol, formaldehyde, formic acid or carbon monoxide, carbon dioxide and water.

H. S. Blackmore, United States Patent No. 774,824, of Nov. 15, 1904, claims to have invented a process whereby methane when heated under a temperature of 260 deg. Fahr. with various metallic oxides as a source of oxygen obtains from 1,500 cu. ft. of methane, 125 lb. of methyl or wood alcohol, and at a temperature of 315 deg. Fahr., from 1,500 cu. ft. of methane produces 118 lb. of formaldehyde. The metallic oxide used as a source of oxygen were ferroso-ferric oxide, cupric oxide, and manganese and barium dioxides.

In United States Patent No. 891,753, another investigator has found that when methane is treated at temperatures from 86 to 122 deg. Fahr., with air in the presence of oak bark as catalyzer, he obtains from less than 1 cu. ft. of methane slightly less than 4 lb. of formaldehyde. He also claims that small quantities of methyl or wood alcohol and formic acid are produced. An abstract of this work may be found in the *Journal of the Society of the Chemical Industry*, Vol. 27, page 918.

Glock, in German Patent No. 109,014, claims that methane and air in equal volumes when passed through a tube containing granulated copper as a catalyst yields at a temperature of 112 deg. Fahr. formaldehyde in commercial quantities. Numerous other investigators, as Otto, Coquillon, Bone and Smith, and Bone and Wheeler, have made similar observations, viz., that methane in the presence of air and catalysts at certain temperatures yields formaldehyde.

Dennis and Hopkins, in the *Journal of the American Chemical Society*, Vol. 21, page 309, give a description of a laboratory method of converting methane into carbon monoxide.

The speaker has personally investigated the conversion of methane into carbon monoxide and finds that under the proper conditions, to wit: (a) Relative values of methane and air interacting; (b) presence of certain catalysts; (c) definite rate of flow, and (d) carefully regulated temperatures; that it is possible to convert methane into more than 90 per cent of the theoretical quantity of carbon monoxide. This particular phase of the chemistry of methane was studied on account of the commercial importance of the following products which can be derived from carbon monoxide by simple chemical changes: (1) Carbonyl chloride or phosgene; (2) formic acid, and (3) oxalic acid.

Carbonyl chloride is used very extensively at the present time in offensive gas warfare and in the synthetic dye industry. It commands a price which is quoted as nominal. This means that the product is difficult to obtain and then only at a good price. Formic and oxalic acid find ready sale at from 35 to 45 cents per pound in large containers.

Lemoine and Senderens, working independently, in 1907 found that when carbon monoxide and chlorine in equal volumes are passed through a suitably constructed apparatus containing wood charcoal as catalyst, react to produce quantitatively carbonyl chloride or phosgene. This is the commercial method of manufacture.

English Patents Nos. 4,684 and 9,008, French Patents Nos. 342,168 and 421,227, and numerous scientific articles describe processes for the manufacture of the salts of formic acid. These processes in the main consist of passing carbon monoxide in the presence of various catalysts at different temperatures into caustic soda, caustic potash and quick lime under some pressure to produce the salts of formic acid. These salts by simple treatment with sulphuric acid yield pure formic acid. This acid is manufactured on a large scale in Germany by this process.

If the salts of formic acid as prepared by the methods just given are heated to temperatures ranging from 680 to 770 deg. Fahr., these undergo chemical change resulting in the production of pure hydrogen and the salts of oxalic acid, from which oxalic acid can be derived by treatment with sulphuric acid. German Patent No. 229,853 is a description of a process wherein 1 per cent of borax or 5 per cent of boric acid is used as catalysts. The optimum temperature is as given above and the yield is 88 per cent of the theoretical. German Patent No. 269,883 is a description of a process for the manufacture of oxalates from formates wherein the best temperature is given as 725 to 752 deg. Fahr. V. Merz and W. Weith, in *Berichte*, Vol. 15, page 1513, describe a process whereby sodium formates when heated out of contact of air at a temperature of 752 deg. Fahr. is converted into 70 per cent of the theoretical quantity of exalate.

The above instances of the chemical changes which occur when methane is burned either in the presence of air or oxygen, are given for the purpose of showing the state of the art. The speaker feels that it is entirely possible to develop commercial processes whereby the following substances may be produced from natural gas: Formaldehyde, formic acid, oxalic acid and carbonyl chloride.

(*b*) *Reactions with Chlorine.*

Since 1879 a great many chemists have devoted much time to a study of the problem of the chlorination of natural gas. Mallet has two patents on this subject—United States Patents Nos. 220,397 and 880,900. Professor Francis C. Phillips, of the University of Pittsburgh, has published more or less extensively on this subject in the *American Chemical Journal*. Elworthy holds French Patent 35,291 and German Patent 222,919, covering processes on this subject. Baskerville and Hamor, of the College of the City of New York, have done more or less extensive work in this field. McKay holds United States Patent 1,009,428. The subject, therefore, is one which has received more than passing attention. The industrial application of the reactions and processes described in any of the above mentioned literature or patents has not been made. In the fall of 1915 the speaker in conjunction with his assistants took up the study of this problem. The natural gas which was used was that furnished by the Equitable Gas Company to the Mellon Institute of the University of Pittsburgh. The chlorine used was liquid chlorine produced by the Electro Bleaching Company, of Niagara Falls, N. Y. The conditions of experimentation were varied from time to time until optimum conditions of operation were learned. It was found that when a mixture of natural gas (5 cu. ft.) and chlorine (4 cu. ft.) was passed through a tube at a temperature of from 518 to 554 deg. Fahr., using clay, pumice, infusorial earth, or luminum chloride as catalysts, that a reaction occurred smoothly and regularly, resulting in the production of the following substances: Methyl chloride, methylene chloride, chloroform, carbon tetrachloride and muriatic acid, together with small quantities of complex chlorinated hydrocarbons. Using the data derived from the laboratory work it was found by calculation that 1,000 cu. ft. of natural gas when treated with 526.4 lb. of chlorine will give:

51.34 lb. carbon tetrachloride, worth 15½ cents per pound.
189.8 lb. chloroform, worth 75 cents per pound.
62.86 lb. methylene chloride, market price nominal.
13.06 lb. methyl chloride, market price nominal, and
567.00 lb. muriatic acid, containing 37.9 per cent of hydrogen chloride, worth 1¼ cents per pound.

Both methylene chloride and methyl chloride can be easily converted into chloroform and carbon tetrachloride by another simple reaction, using metallic iron or ferric chloride as catalysts and the yields of chloroform and carbon tetrachloride increased.

Chloroform a By-product

There are many gas fields in the United States and Canada which are not only remote from market, but which contain more than 95 per cent methane, and would thus be suitable for the manufacture of chloroform, carbon tetrachloride and muriatic acid. In consideration of the fact that practically all of the chlorine on the market to-day is manufactured at points where there is cheap power, and that the gas spoken of is in regions remote from market, it would be necessary for any natural gas producing company manufacturing these chlorinated products to install a plant for the manufacture of chlorine. Caustic soda and hydrogen in large quantities would be produced as by-products, and these in turn would have to be disposed of or utilized profitably at the point of production. The success of industrial Germany along chemical lines is due to the fact that wherever an industry has been established and there are by-products resulting from this industry, additional processes have been installed or invested whereby nothing but finished products is obtained.

In other words, a program has been outlined which enables anyone owning natural gas in regions isolated or remote from market to install a series of processes by means of which all of the natural gas can be utilized in a highly important and commercial way.

Not only have the chlorination reactions of natural gas, as a mixture, been studied, but particular attention has been paid to the chlorination of butane. On account of the fact that butane is a mother hydrocarbon of the following substances, butyl chloride and butylene chloride, it is from these substances that a large number of important commercial products are obtainable theoretically. Butyl chloride should, under the proper conditions of chemical change, such as are well known in the laboratory, yield butyl alcohol, butyl aldehyde, butyric acid and dipropylkatone. Butyric acid is the fatty acid derivable by saponification from butter fat. Dipropylkatone is a product which has the same commercial uses as acetone and many other additional uses in the explosive industry. Butylene chloride upon treatment with alkalies yields a hydrocarbon known as butadiene. This hydrocarbon is of practical interest, as it is the one which is the basis of the artificial rubber industry. In the *Journal of Metallurgical and Chemical Engineering* of May 1, 1917, pages 513 to 518, can be found an article giving a rather comprehensive statement of the chemical changes required to produce artificial rubber from butadiene. British Patent No. 15,254 gives two methods of producing artificial caoutchouc. The methods are as follows:

1. Butadiene dissolved in benzol is heated ten hours at 150 deg. C. for a number of days.

2. Butadiene condensed at a low temperature by means of ether and carbon dioxide is kept in an autoclave at 90 to 100 deg. C. for four days. In both cases the solvents, unreacted upon material and by-products, are distilled off in vacuo or by steam, and a rubber-like mass remains.

Harries, in the *Annallen*, 1911, pages 157 and 383, describes another method whereby butadiene or its derivatives are heated with sodium wire. The yield is almost quantitative and the product obtained may be vulcanized quite readily. British Patent No. 26,550 claims an advantage over the Harries process by conducting the operation in the presence of carbon dioxide. Matthews, in British Patent No. 2,070, effects the same change in the presence of sulphuric dioxide. The process of Matthews is essentially as follows:

Butadiene or its derivatives are heated with sodium wire in the presence of benzol. Liquid sulphuridioxide is then added to the cooled solution and the mixture warmed in a sealed vessel at 40 deg. C. After some time the vessel is opened, when the solution is found to be very viscous and in some cases set to a jelly. On removal of the sulphur dioxide the product will be found to be elastic and to resemble natural caoutchouc.

The products obtainable by the various methods are elastic, easily soluble in the ordinary rubber solvents, and capable of vulcanization. Many scientists are at work endeavoring to discover a process whereby artificial rub-

ber may be produced at a cost which will enable it to compete with the natural product.

Developing a Process for Making Artificial Rubber

The present status of the artificial rubber industry is much more promising than the artificial indigo industry was in its inception. The demand for indigo was relatively small, while the demand for rubber products has grown with remarkable rapidity along with the automobile industry. It is not to be expected that a synthesis so difficult and complicated as that of rubber could be effected without a great expenditure of time, energy and money. The ground work has been well laid, and I believe that American industry, which is to be at once the servant and master of world industry, will not be found wanting in supplying all that is needed to develop a process for the production of rubber. Natural gas, with its content of pentane and butane, which compounds can be readily and easily isolated, forms the hydrocarbon basis upon which the artifieial rubber industry can be built.

Valuable By-products Which May Be Obtained by Synthetic Chemical Reactions from the Exhaust Gas of the Gas Engine

About the middle of the Seventeenth century Robert Boyle made the following statement:

"The air is a confused aggregate of effluviums from such different bodies, that, though they all agree in constituting by their minuteness and various motions one great mass of matter, yet perhaps there is scarcely a more heterogeneous body in the world."

These words forcefully impress the fact that air is a mixture of several different gases. Oxygen, nitrogen, carbon dioxide and the rare or noble gases, are the main components of the atmosphere. Generally speaking the following is the average percentage composition of air, by volume, nitrogen, 78.03; oxygen, 20.99; rare or noble gases, 0.95; carbon dioxide, 0.03. Of the rare or noble gases argon exists in the largest quantity, 1,000 volumes of air contain approximately 9.37 volumes or less than 1 per cent of argon.

When air is mixed with natural gas, and this mixture exploded in a gas engine, the hydrocarbons of natural gas react with the oxygen of the air to produce carbon dioxide and water vapor. The other constituents of air do not undergo any chemical change. The exhaust from a gas engine contains, therefore, nitrogen, the rare or noble gases, carbon dioxide, and water vapor. It is to these substances that I would have you pay particular attention at this time. If the exhaust gas is cooled by passage through coils sprayed with ordinary water and then compressed to a pressure of from 25 to 30 lb., practically all, if not all, of the water vapor present would be removed as liquid water. The remaining gas after such compression could then be treated according to a French patent of George Claude, for the recovery of carbon dioxide. In principle this process consists in passing the gas containing carbon dioxide through a body of liquid water under pressure, keeping the gravity of the water at such a point that practically all of the carbon dioxide is dissolved by the water at the temperature and pressure used. The unabsorbed gases consist of nitrogen and the rare or noble gases. The water containing the carbon dioxide dissolved under pressure can flow to a suitably constructed apparatus in which the pressure is lowered.

The carbon dioxide thus evolved can be picked up by a compressor and liquefied, and as such sold on the market for all the purposes as carbon dioxide prepared in other ways. R. F. Brownlee and R. H. Uhlinger have American Patents No. 1,150,337 and No. 1,154,172, covering processes for the manufacture of carbon dioxide and nitrogen from natural gas.

In a preliminary report to the Ordnance Department of the War Department on the nitrogen industry by Charles L. Parsons, published in the *Journal of Industrial and Engineering Chemistry*, of September, 1917, pages 833 to 841, will be found a discussion of the methods utilized for the production of nitric acid and ammonia from the nitrogen of the air. Three of these processes—the Haber process the cyanamid process and the cyanide process—all require practically pure atmospheric nitrogen.

The Haber process is a German one and consists of taking hydrogen and nitrogen and causing them to undergo chemical change at a temperature of about 500 deg. C. and at pressures from 125 to 150 atmospheres to form ammonia. This process is the one now mainly used in Germany. During the year 1917 the output by this process was equivalent to about 500,000 tons of ammonium sulphate. The ammonia obtained by this process can be oxidized and converted into nitric acid.

The cyanamid process is used quite extensively in both Europe and America. This process consists of heating calcium carbide to a red heat in the presence of nitrogen. The cyanamid produced is then powdered and mixed with sodium carbonate and lime, and the mixture treated with steam in large autoclaves to convert the nitrogen of the cyanamid into ammonia. In 1917 the German production of cyanamid was approximately 400,000 tons. Cyanamid is not only useful as a source of ammonia and ammonium compounds, but is well suited for use as a fertilizer when applied directly to the soil.

The cyanide process is, up to the present time, not a commercial success. The process consists of heating a mixture of sodium carbonate, ground coke or carbon in contact with finely divided iron to redness and then passing nitrogen through the mass. A reaction takes place rapidly, resulting in the formation of sodium cyanide.

The Chemical Possibilities of Natural Gas

It will be seen from the above that the nitrogen contained in the discharge gases from gas engines has many chemical possibilities in the production of compounds which are industrially very important.

Argon and the rare or noble gases, on account of the fact that these substances undergo no chemical change of any kind, will certainly be left in the residue gas after the recovery of carbon dioxide and the fixation of the nitrogen.

Raleigh was enabled to isolate argon and other rare gases from the atmosphere in 1893 by making use of the chemical inertia of these substances. Argon is a gas without color, taste or smell. It is incombustible and a non-supporter of combustion. Recently it has been shown that argon may find extensive use in the electric bulb industry.

The dawn of the day of the American industrial empire is upon us, and as the light of it breaks, the most splendid possibilities are revealed to us. In no field

of commercial endeavor are its possibilities greater than in the industries having specifically to do with oil and gas. There are the possibilities of food for mankind and heat to prepare it for his growth and development. There is medicine to cure his ills and drown his sorrows; light to illumine his pathway and make it more cheery; materials to clothe, adorn and glorify the bodies of men. It is a most auspicious and prophetic time, and one which is worthy of the most serious and thoughtful consideration. It is the time above all times when men of vision and men of courage are needed. It is not an impossible time, but is one where the greatest of results may be realized if the efforts are properly directed. Subsidized chemical and engineering research is the keynote to the commercial realization of the possibilities of this age. The Natural Gas Men's Association can do its bit by entering upon a program of subsidized and heartily supported research.

How the Gas Companies Are Helping the Nation

THE BINGHAMTON LIGHT, HEAT & POWER COMPANY'S final figures for the Liberty Loan drive show that a total of $4,400 has been subscribed by the employees.

PRIVATE HARRY EISENBERG, of Company L, Twenty-third Engineers, has arrived safely in France. Private Eisenberg before enlisting was assistant superintendent of the Worcester Gas Light Company, Worcester, Mass.

THE LOUISVILLE GAS & ELECTRIC COMPANY, Louisville, Ky., has placed at the disposal of the community garden committee an entire block at the corner of Twenty-eighth Street and Broadway.

THE CHAMBERSBURG (PA.) GAS COMPANY employees went 100 per cent in the Liberty Loan subscriptions, every man and every woman taking at least one bond.

MARTIN SANDS, general bookkeeper of the El Reno division of the Oklahoma Gas & Electric Company, has entered the Navy.

THE DENVER GAS & ELECTRIC LIGHT COMPANY, of Denver, Col., has on its honor roll the following employees' names:

Samuel L. Crump.....Cadet Engineer, Special Engineering
C. B. Harris..Cadet Engineer, Signal Corps, Aviation Sec.
Earle L. Martin..U. S. Navy, Mare Island, San Francisco
Wm. S. Morrison....Cadet Eng., U. S. A., Camp Funston
C. J. Melrose..Cadet Eng., U. S. Navy, 3d Class Electrician
F. J. Moore....Bookkeeper, Mechanic, Naval Aviation, Balboa Park, San Diego, Cal.

JOSEPH PEAVY, formerly assistant engineer of the Meridian Light & Railway Company, Meridian, Mass., is now in the United States Navy and is stationed at the Newport Training School, Newport, R. I.

CORPORAL JAMESON LEWIS, formerly with the Medina Gas & Fuel Company, Wooster, Ohio, is now with the Twenty-fifth Squadron, Aviation Camp, Waco, Texas. In a recent letter to the JOURNAL, Mr. Lewis writes:

"I have been here since the first of March. About three weeks ago I was included in regimental orders as an acting corporal and am assigned to this squadron together with about 125 men picked from the brigade to be given special intensive training along the lines of infantry drill.

"In this camp we live in tents. Our food is of the best; for instance, I have just finished noon mess, consisting of hot biscuits, fried bread, syrup, beef stew (the best I ever ate), butter and iced tea. We are near Camp MacArthur, formerly the Wisconsin-Michigan National Guard camp, and are right next to Rich Field, one of the smaller aviation training camps. Our own part of the camp is made up of four regiments of the Aviation Section Signal Corps, mostly recruit squadrons, receiving training."

CORPORAL ORVILLE B. BARTRAM, formerly with the Sioux City Gas & Electric Company, Sioux City, Iowa, is now somewhere in France. He can be reached by addressing him, care of Company L, 168th Infantry, American Expeditionary Forces, France, via New York. Corporal Bartram in a letter to the JOURNAL writes:

"I am coming along pretty good just at present. Have been in a few scraps with Mister Boche, but so far have come out without a single scratch.

"Sometimes business booms, then again it is pretty dull. Everytime we have been matched against the Boche so far we have come out of it with colors flying. Our losses have been very slight. I most assuredly believe that we have got more Boche than what men they have got of us.

"The thing that gets my goat over here is the weather. Back in the States we hear of 'Sunny France.' I don't know where it comes from, unless it is in a different part of the country than what I have been in. It is most always raining over here and chilly. We haven't had a clear day for over a month, I believe.

"The Boche made a pretty fair drive up at the Somme, but he is a long ways from having us beat yet. There is only one side that is going to win in this war, and that is the 'Allies.' I'd just like to see the Boche try to crack the line here; I'll bet they'd get an awful setback; they might come a little ways, but they would pay dear.

"I shall close this with wishing 'Victory and Good Luck' to the Allies.

"(Signed) O. B. BARTRAM."

Gas for Boiler Firing in Illinois

The labor-saving effect of gas used to fire a 20-hp. boiler and for other new industrial purposes is described in an article in the current issue of the *Public Service Lumen*, issued by the Public Service Company of Northern Illinois. The article says:

"Gas as fuel from the mains of the Public Service Company, is being burned under a 20-hp. boiler in a large industrial plant in the western division. Additional boiler units are to be installed. Although the expense is considerable, this is offset by the saving made in necessary hand-firing when coal is used. Another large customer is using gas in a low-pressure boiler to supply steam for 1,000 ft. of radiation.

"One of the newest applications of gas for industrial purposes is made in a plant in the territory south of Chicago in the process of making bolt heads. This operation as ordinarily performed requires rods to be placed in a slot in a furnace usually fired by oil. It was found with gas, as it is possible to focus it more directly on the rods, that considerable time is saved. In fact, the daily output of the factory since gas was installed has risen from 3,500 bolts to 4,000.

Muskegon Company Advances Certain of its Rates

Due to the advanced cost of materials, especially mantels, there has been put in effect an advance by the Muskegon (Mich.) Traction & Lighting Company on the cost of maintenance of a number of large gas lights in that city, especially arc lights. The advance will be only sufficient to cover the advanced cost. Practically no householders are affected.

Pittsburgh Company Wants Rate for Natural Gas Increased

The Greensboro Gas Company, of Pittsburgh, Pa., operating in Washington, Greene, Fayette and Westmoreland Counties, has filed with the public service commission a new tariff of rates for natural gas service, effective June 1, 1918, making an increase in existing rates to industrial consumers.

The existing rates of 29 cents and 26 cents per 1,000 cu. ft. for gas supplied in excess of 500,000 cu. ft. per month are withdrawn, and a uniform rate of 31 cents per 1,000 is established as the rates for all gas supplied to industrial consumers, which rate is subject to a discount of 1 cent per 1,000 cu. ft. for prompt payment of monthly bills.

Societies and Associations

THE BROCKTON (MASS.) GAS LIGHT COMPANY EMPLOYEES' ASSOCIATION held a meeting Monday evening, May 13, in K. of C. Hall. After the meeting a card party and smoker took place, followed by an entertainment and refreshments.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS will hold the spring meeting this year at Worcester, Mass., June 4 to 7, with headquarters at the Hotel Bancroft. Professional sessions will be held both at the hotel and at the Worcester Polytechnic Institute, and will largely relate to questions with which engineers are now having to deal in connection with the war. The program is arranged as follows: Tuesday evening, June 4—Welcome by the Mayor and the president of the Chamber of Commerce, with an address upon "The Growth of an Industrial City," by Charles G. Washburn (Hotel Bancroft). Reception and musical program at the Worcester Art Museum, followed by dancing. Wednesday, June 5—Professional sessions, morning and afternoon (Worcester Polytechnic Institute). Papers contributed by the local sections of New England and of the Providence Engineering Society, miscellaneous papers on technical subjects; a paper on "Safety Education in Technical Schools and Universities." General war sessions, evening (Hotel Bancroft). Addresses on the procurement program of the Government, after which the party will adjourn to the roof garden. During the day the ladies will visit the Crompton & Knowles Loom Works to witness the operation of fancy looms, and the plant of the Royal Worcester Corset Company, where luncheon will be served. Late in the afternoon there will be a tea and reception at the Tatnuck Country Club. Thursday, June 6—Special sessions, morning (Worcester Polytechnic Institute). Fuel economy, vocational training and general engineering subjects. Luncheon will be served at the Norton company's plant, where a brief session will be held in the afternoon, after which there will be an inspection of the interesting community housing and garden projects of this company. Dinner at the Worcester Country Club, with a lecture on "Harvard's Contribution to Astronomy," by Dr. S. I. Bailey, followed by dancing. Friday, June 7—This day is reserved for an automobile trip to Camp Devens, via Clinton Dam; lunch at Camp Devens; continuation of the trip to Concord and Lexington, returning via the Wayside Inn. The following papers will be presented at this meeting: "Foundry Cost and Accounting System," by W. W. Bird; "The Public Interest as the Bed Rock of Professional Practice," by Morris L. Cooke; "Moisture Reabsorption of Air-Dried Douglas Fir and Hard Pine, and the Effect on the Compressive Strengths," by Irving H. Cowdrey; "A High-Speed Air and Gas Washer," by Lieut. J. L. Alden; "Investigation of the Uses of Steam in the Canning Industries," Julian C. Smallwood; "Efficiency of Gear-Drives," by C. M. Allen and F. W. Roys; "Some Economic Aspects of Fire Protection," by J. Donald Pryor and Frank V. Sackett; "Self-Adjusting Spring-Thrust Bearing," by H. G. Reist; "Air Propulsion," by Morgan Brooks; "The Elastic Indentation of Steel Balls Under Pressure," by C. A. Briggs, W. C. Chapin and H. G. Heil; "Electric Heating of Molds," by Harold E. White; "Stresses in Machines When Starting or Stopping," by F. Hymans; "An Investigation of the Fuel Problem in the Middle West," by A. A. Potter; "Oil Fuel in New England Power Plants," by H. W. Ballou, and "Problems and Hazards in War Times."

Personal Notes

E. A. AUGENSTEIN recently has become manager of the appliance department of the Rochester Railway & Light Company, Rochester, N. Y.

F. BEASLEY, formerly with the Richmond (Ind.) Light, Heat & Power Company, has been appointed secretary of the Union Gas & Electric Company, Bloomington, Ill., succeeding J. W. Brown.

FRANK E. HOLLIS has resigned his position as commercial manager of the Citizens Gas Company, Terre Haute, Ind.

W. S. HILL, who has had charge of the commercial department of the Springfield (Mo.) Gas & Electric Company, has been appointed superintendent of the electrical department to succeed J. D. Bowles, who resigned recently to accept a position with a Cedar Rapids, Iowa, manufacturing company.

THE NEW YORK MUTUAL GAS LIGHT COMPANY, at the annual meeting of the stockholders at the office of the company, 142 East Fifteenth Street, elected the following directors for the ensuing year: George F. Baker, Nicholas F. Brady, George B. Cortelyou, James B. Ford, Lewis B. Gawtry, Donald G. Geddes, James N. Jarbie, Edward S. Marston, William Rockefeller, William G. Rockefeller, John W. Sterling and George W. Parkhurst.

HUGH D. WOOD resigned his position as manager of the New Bern (N. C.) Gas & Fuel Company.

T. B. INGLIS, for some time connected with the securities department of the Northern States Power Company, has been transferred to the securities department of the Oklahoma Gas & Electric Company, Oklahoma City, Okla.

THE SCRANTON GAS & WATER COMPANY and the HYDE PARK GAS COMPANY held the annual meeting of the stockholders recently, at which the following officers and directors were re-elected: Worthington Scranton, president; Joseph Jeffrey, secretary and treasurer. Directors: Worthington Scranton, H. A. Knapp, G. B. Smith, C. S. Woolworth and Joseph Jeffrey. Although both companies are independent of each other the same officers and directors were elected for both companies.

R. C. BEEBE recently went to Rochester, Minn., to assume the management of the Rochester Utility Company, owners of the gas house and mains. He succeeds Charles H. Morrish, who had been in charge for sixteen months. Mr. Beebe is a young man of wide experience in the business and he has been connected with the gas company owners for a long time.

C. H. MORRISH, formerly general manager of the Rochester Utility Company, will have charge of the Otsego, Alleghan and Plainwell plants at Michigan. His headquarters will be at Otsego.

I. BOWDOIN COCKE tendered his resignation as superintendent of the gas department of the Newport News (Va.) Hampton Railway, Gas & Electric Company to accept a position as assistant plant engineer for the Hyatt Roller Bearing Company, a division of the United Motors Company, of Newark, N. J. This company manufactures large quantities of uncarbureted water gas for heat-treating purposes. Mr. Cocke will assume his new duties on June 1.

MARTIN CONLIN, for thirty years chief engineer of the Consolidated Gas Company, of New York, died recently at his home in Greenwich, Conn., aged sixty-seven.

Pennsylvania Companies File Notice of Readiness-to-Serve Charge

The Parkesburg Company, the Atglen Gas Company and the Christiania Gas Company filed new tariff rates with the public service commission, effective June 1, providing for the establishment of a readiness-to-serve charge of 75 cents per month on all meters, in addition to the unit rates charged for gas consumed.

With the establishment of the readiness-to-serve charge the minimum rate of 75 cents per month is discontinued.

Dr. W. Held Offers Government Formula of Liquid Anti-Toxin for Chlorine Gas

Dr. William Held, professor of epilepsy at the Illinois Post-Graduate Hospital in Chicago, after two months of experimentation believes he has discovered a liquid anti-toxin for chlorine gas. Dr. Held has wired to Washington offering the formula of this anti-toxin to the Government for use against the German gas attacks.

Construction Notes

Contract Awarded for New Chemical and Gas Plant in Toledo

H. L. Doherty & Company has let the contract for a new chemical and gas plant to be erected west of the Rail-Light car barns on Central Avenue, Toledo, Ohio.

The present contract calls for buildings costing $110,000, but it is expected the entire plant when finished will cost $500,000. Natural gas is to be manufactured for the Overland, coke will be used to heat city cars, and chemicals for making explosives will be manufactured from the coal tar products for the Government.

A condenser and boiler room, large coal and coke bins, office buildings and dynamo rooms will be constructed at once. The A. Bentley & Sons Company are the contractors. The plant is to be on property of the Rail-Light, a Doherty company.

Additional 30 Koppers Ovens for Indiana Coke Plant

It was recently announced that the H. Koppers Company would build for the Indiana Coke & Gas Company, of Terre Haute, Ind., an addition to their present by-product coke plant to consist of fifteen Koppers ovens. The Indiana company has since decided to build an addition to the plant of thirty Koppers ovens. This will double the capacity of the plant and will result in increased production of toluol and ammonia for the Government.

Rate Increase Asked at Salem for Enlargements

To provide sufficient revenue to meet increased cost of operation the Salem, Ore., office of the Portland Railway, Light & Power Company finds that an increase in rates is necessary, and has petitioned the public service commission to allow the increase. If the increase is allowed a third gas bench will be provided to increase the supply of gas for Salem. A shortage of gas for cooking and heating during the coming summer and fall is threatened, according to W. M. Hamilton, Willamette Valley manager.

Manager Hamilton recently made the following statement:

"On account of its financial condition the officers of the company are having great difficulty in raising enough money to provide for the necessary additions and enlargements to the company's various plants and distributing lines.

Ogden Company Lets Contract to Bore for Gas in Wilson Lane

Lumber was recently hauled to the Covi farm in Wilson Lane and work started on the erecting of a derrick to be used in driving for gas.

A contract has been let by the Ogden (Utah) Oil & Gas Corporation to A. E. Beller, who will begin boring as soon as the equipment can be placed in position.

Will S. White, in charge of the undertaking, purchased 1,000 ft. of casing through the George A. Lowe Company.

The company expects to strike a heavy flow of gas at a depth of 600 to 800 ft.